LOUISIANA Wildlife INVENTORY

by

LYLE S. ST. AMANT

LOUISIANA WILDLIFE & FISHERIES COMMISSION
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LOUISIANA WILDLIFE INVENTORY AND MANAGEMENT PLAN

by

DR. LYLE S. ST. AMANT
Leader of Pittman-Robertson Project 8-R

Photographs, Diagrams and Maps by Personnel of
The Louisiana Wild Life & Fisheries Commission

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INTRODUCTION

In recent years only those states which have based their game conservation program on sound game management practices have been able to maintain or improve the supply of game for the ever-increasing number of hunters. Although game management is a new science, it is rapidly proving its worth and is being accepted and applied in many states. Louisiana is no exception.

In order to undertake the scientific management of game, it is necessary to have a point of departure. This point is usually a basic inventory of the game and game conditions on hand. From the basic facts collected on such an inventory a planned program may be instituted and the amount of success or failure of such a program may be measured against the original findings. Without such a standard, there is no way to determine failures of management or critical decreases in game until it is too late to take corrective measures. This report is the initial inventory of game for Louisiana.

The results reported here were accomplished on Pittman-Robertson Project 8-R: "A State-wide Wildlife Inventory and Management Plan for Louisiana". This federal-aid project, financed by both State and Federal funds, was initiated in March 1946; the major portion of the field investigations was completed by the end of June 1950. Analysis of data and compiling of the final report was completed by July 1951.

In order that this initial inventory of Louisiana's game and game conditions be as complete and as accurate as possible, every available source of information was used to the greatest possible extent. These findings, therefore, not only represent a thorough sifting and analysis of a four-year collection of field data, but also include the basic findings of more recently initiated federal-aid projects, research work at Louisiana State University, information from various public agencies, and the thoughts and ideas of many game management technicians and researchers.

The material gathered has probably been presented in more detail and with more background information than is needed by the trained technician. This has been done to enable the report to be used to inform interested sportsmen and the public, in general, about the game conditions existing in their State.

In the general plan of the report, liberal use has been made of tables, charts, graphs, and maps to present the actual inventory data and its analysis. The bare inventory facts, however, do not necessarily portray the changes and the agents causing the changes in game conditions from former years of plenty of the present sparse supply. The major cause of the changing game picture is the gradual change in land utilization that has occurred over the years. For this reason, the report emphasizes the correlation between land use and game conditions, but all limiting factors are treated to the fullest extent of the available information. In addition to a discussion of the limiting factors controlling game conditions, the future trends are examined and recommendations for the improvement or maintenance of good game conditions are offered.

It is realized that, in presenting so much material about so large an area, there is bound to be some error and certainly some divergence of opinion may arise over the ideas presented here. Such is only natural and necessary, for upon differences of opinion progress is made. Nevertheless, it is believed that most of the material offered here is based upon enough field data and is supplemented or substantiated by enough work by other researchers to be useful as a basic inventory of Louisiana's game and therefore, a point from which a game management plan for the State may be developed.

METHODS AND GENERAL PLAN OF INVESTIGATION

At the initiation of this project, a survey of the literature was made in an attempt to discover methods of handling the various phases of a game inventory of as large an area as the State of Louisiana. The literature indicates that many authorities are in agreement on what should be done and the type of data needed. Numerous direct and indirect methods of doing game and habitat inventories on small specific areas are to be found. Many of these could possibly be applied over large areas if manpower and time were not limiting factors. Studies of previous work, however, failed to disclose methods directly designed for or applicable to a large scale program to be carried out with very definite personnel and time limitations, and few if any were developed in or designed for the Southern United States.

In an attempt to overcome this marked lack of information in the literature, workers in other Southern States where inventories were in progress or completed were consulted. The information gained from them was very helpful in preventing a repetition of their mistakes but offered little that could be applied directly to a new area.

From most sources of information, it became obvious that where large scale inventories have been carried out, the person in direct charge of the work had to devise methods suitable for his area, his time, finances, and personnel limitations as well as for the number and importance of the species to be studied. In most cases where such inventories have been carried out on large areas and where a number of species were involved, actual censuses were not made but rather every effort was made to arrive at reasonable and usable estimates. This inventory of Louisiana's game is no exception. Few, if any, of the methods used here can be considered more than estimates but an attempt has been made to make them reasonable and useful.

Since this is the case, the following discussion is an explanation of the methods used in the inventory in Louisiana and the reasons for choosing these methods.

METHODS OF STUDYING AND RECORDING HABITAT INFORMATION

In making an evaluation of habitat, the methods listed below were used. These are described as follows in the same sequence as the work was done.

Maps and Mapping:

Official maps, U.S.G.S. quadrangles, air photographs, and available forest, soil, and geological type maps covering the area were secured. From these, plus the necessary additional field observations, a habitat type map was made up on as large a scale as practical for each parish showing the major forest types, the distribution of forests, farm lands, and other information affecting game such as highways, centers of population, and waterways.

Statistical Information and Basic Descriptive Habitat Information

A complete habitat study necessitates both a quantative and a qualitative approach to the problem. For basic information in this category, the following sources were used. The forestry acreage figures were, for the most part, taken from the Louisiana Forestry Commission's "Forest Resources of Louisiana" published in 1945. This excellent publication furnished the latest available forest acreages by parishes, by types, and by conditions of reproduction and operability. As a supplement to this source of information, the farm woodlot acreages were obtained from the United States Census of Agriculture for Louisiana. Other supplemental information was used when needed, especially in obtaining historical information of the forests in Louisiana.

From a qualitative standpoint, the forest types of Louisiana and the extent of each type was worked up from accepted standards of information, plus the field observation necessary to verify the accuracy of the information. Insofar as the detail of forest typing is concerned, this was governed by the time and man power available, the point beyond which greater detail was not needed in a general habitat study, and by the fact that type mapping for publication purposes and for general readability must be as uncomplicated and as precise as possible. In general, the following standards were used.

Type classes were based on the standard forest cover types of eastern United States. Additional information and detail of the bottom-land hardwood types was taken from Putnam and Bull, "The Trees of the Bottomland of the Mississippi River Delta Region". For the general distribution and amount of each type, the United States Forest Service type map of Louisiana and various United States Forest Service publications were used. To determine the distribution of forest lands in relation to farm lands, prairies, urban areas, waterways, etc., standard U.S.G.S. quadrangles and air photographs of the State were used. By using the sources of information described above supplemented by field observation, the general game habitats of Louisiana have been typed successfully. Admittedly, however, a more critical analysis of types is desirable where detailed game management is to be carried out. Where refuges have been established or more detail needed, the basic information furnished here has been completed by additional field work carried out on other projects.

In evaluating the farm game habitat of Louisiana, information on farm acreages, types of crops, changes in farm acreages, etc., were taken from the United States Census of Agriculture for each five year interval from 1920-1945. This primary source of information on farm statistics was supplemented by information from the "Louisiana Department of Agriculture Bulletins", "Annual Crop Reports", and information from the Agriculture Extension Service. In general, figures quoted from these sources were used as published. In many cases, however, the data as presented in this report are a summation of the much more detailed data available in the published reports and in many places where percentages are used, these were calculated from the available data. It is also true that where several authorities were used as sources of information, they sometimes did not agree and in some instances the data overlapped. In such cases, an adjustment was made to the nearest point of accuracy as could be determined. In all cases, the figures as cited in this report represent the nearest approach to accuracy that could be readily determined about a constantly changing farm picture. Admittedly, there is some error involved but it is not believed to be too important considering the over-all acreage picture and the general farm habitat conditions, since slight to moderate deviations in the range acreage, particularly in regard to types, is not expected to affect greatly the general game conditions. As pointed out in the introduction, the aim of this report is to show the trend of change in the farm picture over the years and its effect on game. It is believed that the accuracy of the data presented here far exceeds that needed to show what has happened to the farm game areas.

METHODS USED IN ESTIMATING GAME POPULATIONS

As pointed out above, a survey of the literature and consultation with other workers in the field failed to divulge any definite system of accurately censusing the various species of game over large areas. Furthermore, the techniques that have been devised and published for small or moderate sized areas are not generally applicable in the Southern States. For example, the use of airplanes, or snow yard counts, tracks, or browse evaluation so useful in censusing deer in some areas, is of little value over most of the areas involved in Louisiana. The reason for this is obviously too thick cover, a lack of snow, and browse or food, generally, is far in excess of the present deer populations. On the other hand, such census methods as trapping, tagging, or marking game and studying the recapture and movements of animals, that give good results on small areas are obviously not applicable to areas as large as Louisiana.

In attempting to devise suitable methods for the game inventory in Louisiana, several methods were tried. These included actual counts, spot checks, estimates from interviews with sportsmen and land owners, evaluation of annual kill, and others. As the results from initial trials were analyzed, a number of factors soon became obvious and the end result was that these factors dictated the points to be emphasized in the inventory project. These factors are as follows:

1. An actual census figure, no matter how accurate, on any species of game is of little value unless it can be compared to some former figure so that a trend may be determined. Since this is true, it seems that what is needed most is a rapid method of indexing or estimating the populations every year or at other periodic intervals for the purpose of comparison. The method devised may have considerable error or may be only an index but so long as it is kept constant, a trend in population changes would eventually become apparent.

2. Any attempt to be extremely accurate statistically would require man power and time beyond the scope of the project and would still include the error of increases or decreases in population, as the time required for accuracy would prolong the work beyond several breeding and hunting seasons.
3. Some species such as quail may have an expected annual fluctuation of population of as much as 30 per cent because of uncontrolled natural factors such as climate and disease. This makes any census figure of little value unless it is begun and completed just before the hunting season or before the particular season that is being considered. The factor can probably be said to be more or less true of all species having a high breeding potential and short life span, and which are markedly affected by natural changes in habitat conditions.
4. In the case of larger species with low breeding potentials, long life spans, and relatively stable populations, if the range is suitable and stable, the important factors to be determined are whether or not there is a breeding population present, a huntable population, or a population high enough to be damaging the range.
5. Another point that should be kept in mind is that high or low populations per se do not necessarily mean proportionally good or bad hunting. Such factors as terrain, thickness of cover, accessibility of game to the hunter, availability of areas for public hunting, and disproportionate hunting pressure all must be considered in evaluating game conditions. In many instances, maximum populations are so difficult to harvest because of terrain, thick cover, and other factors working against the hunter, that, as far as the public is concerned, there is no game in the area. On the other hand, areas with relatively low populations, if extensive enough and easily hunted, are in general, considered by the public to have high populations because the harvest is moderately high. In some instances, areas considered by the hunter to be poor producers of game are actually producing a maximum amount of game and a harvest that is maximum from a statistical or a game management standpoint. The reason for this is that the high hunting pressure in the area necessitates a division of the harvest to insignificant proportions.

As the above factors resolved themselves, it became evident that an inventory of game and game conditions in Louisiana should show, in general, the approximate amount of game on hand, if possible a comparison of present conditions with earlier conditions, and most important, it should show the cause or causes of the downward or upward trends in game and game conditions from past to present regardless of whether such changes are actual or only relative in the public mind. The inventory should be standardized enough that it may be redone in future years. It should also furnish information suitable for planning future game management practices in the State.

It is believed that the various methods described below for each species, while admittedly not totally accurate, were standardized enough to give an index in the form of an actual population figure that can be used as a starting standard for future comparison. In addition to this, the figures arrived at were quite suitable for working out percentage changes in the analysis of trends and in the comparison of different types of habitat. In so far as the basic accuracy of the methods used is concerned, the following points are offered in support of the results obtained:

1. Population figures arrived at were consistent over several trial runs and were in close agreement with the results from actual counts or from recognized techniques used on small areas or spot checks.
2. Like habitat areas gave the same or similar results, all other factors being equal.
3. Good habitat gave an expected higher population than poor habitat and various types of habitat could be compared as to production.
4. In comparison with the results of inventories from similar habitat in other Southern States, relatively close agreement was obtained. This indicates that the methods used were within standards accepted in most areas.

Described briefly below are the actual way or ways that the population of each species was determined. Those species of greatest importance were allotted the most time and effort and the results are correspondingly more accurate.

DEER:

Approximate deer populations were determined in three ways. In areas with small populations the number, location, and approximate size of the herds were determined by field checks and by interviews with foresters and people familiar with each herd. In most cases, where the total population was under 150, relatively accurate results are believed to have been obtained. In more densely populated areas, the annual kill was determined as accurately as possible and from this the total population was estimated.* The figure arrived at in this manner was then compared to a population figure derived from interviews with persons long familiar with the range and with deer conditions in the area.

SQUIRREL:

An attempt to census all squirrel range in Louisiana is a virtual impossibility on such a project. Spot checks of typical range types were made by nests counts, sight counts, and kill figures. These were found to be in fair agreement with the work done by Goodrum (1938) in East Texas. From these studies, the standard normal per acre production on various types of ranges was estimated. This figure was then applied to the total acreage of each range type in making the estimate of the over-all population.

TURKEY:

In making the turkey census, there were made available to the project the results of two earlier turkey counts, one in 1941-42 and one in 1946. The work done on this project was more or less a verification of earlier counts. In all cases, the number and the size of the flocks were determined by cross-checking reports of flocks and interviewing the people who had actually seen them. The locality of as many flocks as possible was further substantiated by actual determination of turkey signs.

QUAIL:

Quail were censused by actually determining the total population on a representative area of range and from this the per acre production of the range was determined. In most cases, enough coveys were located in each parish to represent a 10 per cent sample. They were located on areas of known acreages picked at random to give a fair sample of all range types. The total quail range was then outlined on maps and the total range acreage determined from agriculture and forestry census figures. The coveys were located in three ways: (1) by personally interviewing sportsmen and having them locate coveys on maps; (2) by interviewing landowners, in particular those who were on their land constantly; (3) by spot checking on farms and taking a complete census of representative samples of cut-over lands with dogs. In all cases of interviews, only the most reliable and obviously authoritative reports were selected in determining productivity of range.

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*Information gathered on this project indicated 10% of the total herd killed each season. This compares favorably with findings in other areas (Trippensee 1948) and with the studies of Lauckhart (1950). The details of these findings are discussed in the deer section.

Large Fur Animals and Predators:

In this group are included the black bear, cougar, wolf, and bobcat. The first three are so rare in the State that simple delimiting of the authentic range and a careful sifting and cross checking of reports and interviews of sight records provided enough information to give a fairly accurate picture of the whereabouts and numbers of these species. In the case of bobcat, the major ranges were delimited and an estimated production per unit area was made from periodic trapping reports from our principal refuges.

Commercial Fur Bearers:

The major range of the commercial fur bearers was determined and the acreages calculated. Records of the State fur catches by species over many years were available as sources of census material. The per acre production was easily established from such information.

Rabbit:

Although rabbits are one of the game types in Louisiana, their range is so extensive (covering virtually every area in the State) and their population so high that no suitable method could be devised to check the population with any assurance of accuracy. For the most part, the information gathered on rabbits indicates the extent of range of the various types, cycles, trends in population, and various factors controlling rabbit population.

Migratory Bird:

Included in this group are the waterfowl, snipe, woodcock, and dove. Since most of these species are only visitors in Louisiana for a few months out of each year, a complete census was not possible on this project. For figures on waterfowl, the United States Fish and Wildlife counts and the findings of Louisiana's Federal Aid waterfowl project were relied on to a great extent. For dove, the annual census from the dove project was taken as the best figure. Woodcock and snipe were only estimated. Aside from actual census figures secured as described, other data gathered on this project included flight patterns, kill figures, general range extent and conditions.

A GENERAL DESCRIPTION OF LOUISIANA IN RELATION TO GAME CONDITIONS

Louisiana, one of the smaller states in the Union, ranking thirtieth in area and twenty-first in population, is located astride the Mississippi River as it enters the Gulf of Mexico. It is bounded by its sister states of Arkansas, Mississippi, and Texas. This State, roughly boot shaped, has an area of 31,043,840 acres (45,409 sq. mile) and is divided into 64 parishes (counties). Its total area may be broken down as follows: 16,183,171* acres (52%) are in forest lands; 10,039,657 acres (34.7%) farm lands; approximately 4,000,000 acres (12.9%) are in coastal marshes and waterways. The remainder of the area is in towns, cities, roadways, and general unclassified lands. The following table gives some of the most important statistical facts about the area, population, and rank of Louisiana in relation to game conditions.

Louisiana's	**Size**	**Remarks**
Land area	29,061,760 acres	Ranks 30th. in U.S.
Water area	1,982,080 acres	Ranks 5th. in U.S.
Total area	31,043,840 acres	Ranks 30th. in U.S.
Population 1940	2,363,880	Ranks 21st. in U.S.
Hunting population	190,000 **	Ranks between 16th. & 21st. in U.S.
Forest acreage	16,183,171 acres	52.0 % of State area
Farm acreage	10,039,657 acres	34.7 % of State land area
Marsh land & Waterways	4,000,000 acres	12.9 % of State land area

The most striking thing in the facts presented above, is that Louisiana's population and hunting pressure are greater than in more than 60% of the other states, yet its area is only greater than 45% of the other states. This means that the drain on the game production per unit area in Louisiana is higher than in many states and therefore, a higher degree of production is necessary in order to compensate.

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*This contains approximately 2.5 million acres of farm woodlots which are also counted in the farm acreage figures.

**Average license sale for 1947-48, 1948-49.

PHYSIOGRAPHY AND GEOLOGY*

It is not the intention of this report to dwell at great length or in detail on the relationship between physiography, geology, and game. Game, however, is fundamentally a product of the land, and therefore, the basic character of the land must be fully understood in order to analyze and appreciate all of the ramifications of the game picture.

Physiographically, Louisiana may be divided into two sections. One section is the Tertiary Uplands occupying the northwestern part of the State, and the other, the Quaternary Lowlands, occupying the remainder of the State (Map, Fig. 1). The Tertiary Uplands have an underlying sediment of consolidated Tertiary bedrock. This area may be divided into three major sediments. The northern and largest part consists primarily of Eocene sediments and the southern edge passing across central Louisiana is cut by narrow bands of Oligocene and Miocene deposits. This area of Tertiary Uplands is the older of the two physiographic sections. It is higher, topographically, and is maturely dissected. In some places, sandstone out-crops are in evidence, while in others where the area is developed on clays and marls, the topography may be low and flat.

The Quaternary Lowlands are the younger of the two sections. All of this area is of relatively recent origin and the various units are somewhat similar, since they all are composed of the surfaces of Quaternary stream deposits or Deltaic deposits. The Quaternary Lowlands are divided into eight units. Four of these units consist of four terraces, the Williana, Bentley, Montogomery, and Prairie, named in order of age, steepness, and dissection. These are, in general, located in belts across the State just below the Tertiary Uplands. They are bisected in the middle, of course, by the Mississippi River alluvial lands. The remaining four units of the Quaternary section are more recent in origin and consist of two alluvial cone units of the Arkansas and Red Rivers, the alluvial plain of the Mississippi River, and the Deltaic Plain along the coast. (Map, Fig. 1).

Each one of the above sections and the units within a section have certain topographical characteristics and soil types peculiar to

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*An excellent detailed discussion of the relationship between the physiography and geology, and the flora and fauna of Louisiana has been presented as the result of a symposium held at the meeting of the Louisiana Academy of Science. This publication has been used as the basis for much of the information presented here. (See bibliography).

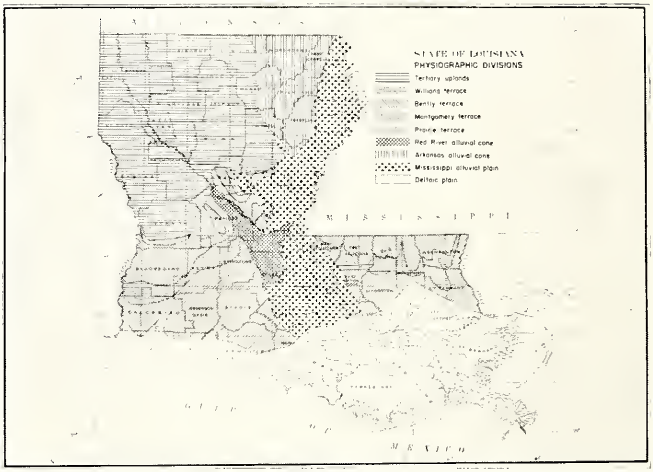


FIGURE 1.

them. This, in turn, results in certain types and amounts of flora being characteristic to each region which, to a great extent, controls the amount and kinds of game on each. The basic nature of these differences is as follows.

TERTIARY UPLANDS:

This is the oldest section of the State, geologically, and makes up most of Northwestern Louisiana. (Fig. 1). This older structure has a base of consolidated Tertiary bedrock and is topographically the highest and most maturely dissected part of the State. Elevation ranges from 200 to 400 feet above sea level and the general appearance of the area is distinctly rolling to hilly with ridges divided by a mature and rather deep stream pattern. Except for the major streams, most of which arise north of the area, the stream pattern is made up of sluggish intermittent types, subject to rapid rises and run-offs during heavy rain. Cool, continously flowing spring creeks are relatively rare in the area. The major soil types of the area are Orangeburg, Greenville, Kirvin, Ruston, Susquehanna, Lufkin, and Sands. The sub-soils range from poorly to well-drained, but for the most part, are of the well-drained type (Fig. 2). In general,

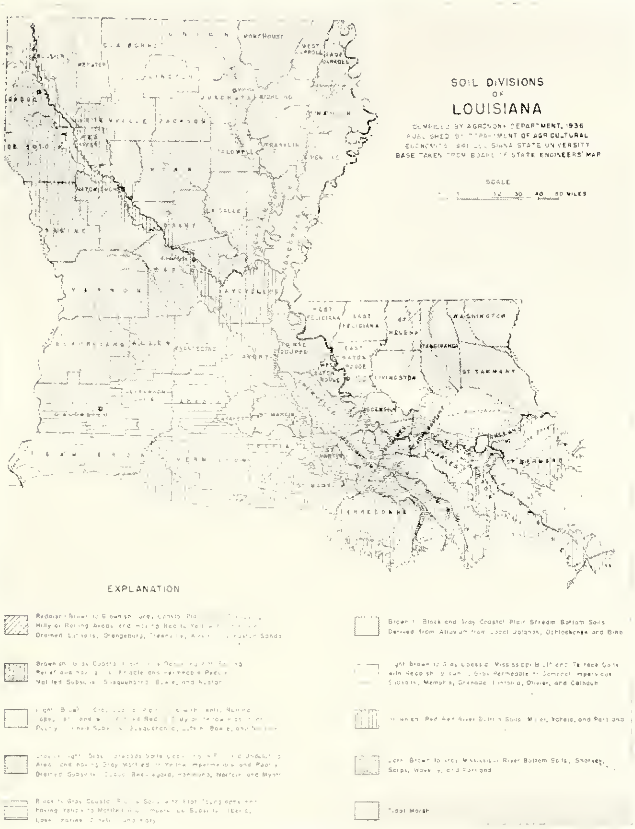


FIGURE 2.

these soils do not compare in productivity with the alluvial river bottom soils but they do represent a better type of hill land soil.

At one time, this large area of hill land was densely clothed in short leaf pine, loblolly pine, and hardwoods with scattered sections of long leaf pine. Since being cut-over, the area has a heavy second growth of pine-hardwoods with the hardwoods, particularly red oaks and scrub oaks, being dominant.

From a game stand point, this area has always produced well and it is potentially one of the better areas in the State today. In primitive times, the dense mixed forests of the area were good producers of large and small forest game types, but principally of deer, turkey, and squirrel. In modern times, with the advent of extensive farming on the better drained lands, quail, dove, and rabbit have increased greatly. At present, the area offers the largest amount of some of the best game range of all types in the State. Potentially, the area can produce any of the game types that have existed in it in sufficient amounts to harvest, if proper game management techniques are applied.

The Terrace Lands:

The four Pleistocene terraces are separated by the steepness of their tilt and the degree of dissection from erosion. The Williana which is the steepest and the most maturely dissected, is the oldest. The Prairie, a nearly flat area, is the youngest.

Williana Terrace Unit: This unit is the oldest of the terraces. It slopes southeastward at the rate of approximately 8 feet per mile. The surface is eroded rather deeply from stream action, in some places having cut through to the older Tertiary bedrock. The sediments underlying the surface are made up of gravel, coarse sand, silt, and some clay, most of which are unconsolidated. Topographically, the area is similar to the Tertiary Uplands. Elevation ranges from 200 to 300 feet. The surface is well dissected by streams and the general appearance is of rolling hills separated by a vast network of intermittent or permanent springfed streamlets. This unit occupies a relatively small area of the State being principally found in Vernon, Rapides, and Grant Parishes. It originally was clothed in longleaf pine, but is now generally barren cut-over land or else is being taken over by scrub oaks. In general, the soils of the area are extremely sandy and poor. Agriculture is at a minimum in the area.

Bentley Terrace: This unit, the second oldest of the terraces, is slightly less steep than the Williana, having an average slope of about 5 feet per mile and dissection from stream erosion is correspondingly less. The sub-surface composition is basically the same as described for the Williana except that there is less gravel.

Topographically, the area presents a series of rolling hills separated by small streams and springheads. Elevations are from 100-200 feet with local relief seldom more than 10 feet.

This terrace unit is the second largest of the group. It makes up considerable portions of the following ten parishes: Beauregard, Vernon, Allen, Rapides, Grant, on the west side of the Mississippi River flood plain, and West Feliciana, East Feliciana, St. Helena, Tangipahoa, and Washington on the east side of the river. (See map, Fig. 1). This area originally supported one of the largest acreages of longleaf pine in the State. Today, most of it is barren, cut-over, and frequently burned grasslands except for a few scrub oaks and the scrub hardwoods and small trees and shrubs that are found in the stream bottoms between the hills. One exception to this condition exists in the parishes east of the river. In the Felicianas and St. Helena, better soils originally produced many hardwoods with the pine. Today, the area is well clothed with second growth loblolly pine and hardwoods. In Tangipahoa and Washington Parishes, the denuded land is gradually being reforested by planting, fire protection, and natural reforestation.

The Montgomery Terrace: This unit, the second youngest of the group, has a few high elevations but is largely confined to an altitude ranging from 80 to 120 feet above sea level. The slope is gradual, being approximately 2 feet to the mile in a southeasternly direction. In comparing this unit to the older units described above, one finds it to be relatively flat to very gently rolling. Compact subsoils of clay make much of this area poorly drained and wet. Most of this area was originally clothed in longleaf pine and is generally known as the pine flatwoods area of the State. Much of the area is cut-over and now growing grasses, gallberry, and waxmyrtle. The hardwoods and loblolly pine-hardwood bottoms along streams are, in general, more extensive in this area than in the Williana and Bentley units. In this area, as in the Bentley, better soils east of the Mississippi River gave rise to mixed hardwoods and pine-hardwoods in East Baton Rouge and Livingston Parishes.

The Montgomery terrace, second smallest of the four units, is located in a narrow band, just south of the Bentley unit. It crosses the State and includes small parts of thirteen parishes. These are Calcasieu, Beauregard, Allen, Evangeline, and Rapides, west of the Mississippi flood plain, and West Feliciana, East Feliciana, East Baton

Rouge, St. Helena, Livingston, Tangipahoa, Washington, and St. Tammany, east of the river. (Fig. 1).

Prairie Terrace Unit: This is the largest and youngest of the terrace units. It has a slope southward of about one foot per mile and topographically, is virtually flat with little or no relief. The subsoils have an extremely high content of compact impervious clays which makes drainage exceedingly poor and allows for much standing surface water after rains. Because of this poor drainage, much of this land west of the Mississippi River is used in rice production.

This area originally supported, principally, a prairie type vegetation or grassland dotted with clumps of hardwood and narrow strips of bottomland hardwoods along stream courses. Some pine flats occurred on the northern edge of the unit and where soils were better drained. For the most part, west of the Mississippi, a true prairie condition existed and still occurs. East of the river, better soils produced heavier growths of hardwoods and second growth pine-hardwoods. (Fig. 12). This area is the largest terrace unit and makes up substantial portions of the following parishes: Calcasieu, Jefferson Davis, Allen, Evangeline, Acadia, St. Landry, Lafayette, and Vermilion, west of the Mississippi River and East Baton Rouge, Livingston, Tangipahoa, St. Tammany, and Washington, east of the Mississippi River flood plain.

The four terrace units can be considered together as far as game production and game potential are concerned. From a historical standpoint, except for one or two localities, the terraces have never been great producers of game. Although there originally were some deer, turkey, squirrel, rabbit, and quail in the area, the poor sandy nature of the soil, the clean understory of park-like stands of virgin pine, and the coverless prairies always precluded extremely heavy game populations. This was so true that early settlers considered it a sterile area. Certain exceptions to this condition occurred in the area where the top soil was richer or because of man-made phenomena. For example, the better top soils occurring in East Feliciana, West Feliciana, East Baton Rouge, Livingston, and St. Helena Parishes produced more mast producing hardwoods and better forest game populations. This is still evident in the vast pine-hardwood second growth forests in these parishes today as contrasted to the denuded terrace lands of western Louisiana. The other exception to this general dearth of game occurred with the phenomenal quail population that occurred in all the pine lands shortly after cutting. This was a short-lived condition because of ecological succession and cannot be considered as truly indicative of the productivity of the terraces. The present-day game potential of the area is not too great unless managed quite extensively. The vast cut-over lands with poor soils and uncontrolled fires can produce, under current conditions, a low quail and rabbit population supplemented by squirrel and woodcock in the creek bottoms and wooded strips. Some excellent deer range occurs in the wider creek bottoms, but the total area of such range is limited and is more or less devoid of a breeding population. In the less well-drained parts of the terrace, hardly any cover is available as almost every available foot of land is in rice production or is grazed. On the other hand, the terrace lands of the State have several compensating factors that make them one of the best prospective game areas of the State in so far as the hunter is concerned. These are: first, the area of good soils east of the Mississippi River and a few areas on the west side have produced second growth forests that offer extensive and excellent opportunities for deer, turkey, and squirrel management; second, the vast cut-over areas furnish probably the only region of any size where there is unrestricted public hunting; third, since these denuded pine lands were once able to produce a good quail population, proper management could, in part, restore this population.

The Arkansas and Red River Alluvial Cone Units

Two units of the more recently formed alluvial lands are distinctly separate because they are no longer receiving sediments nor are they subject to periodic innundation. These units are the cone units of the Arkansas and Red Rivers. They are the result of the lowering of the base level of the major depositing streams until overflow and present day sedimentation do not occur in the areas.

These two cone unit areas are located where the Red River and the Arkansas River originally entered the relatively flat Mississippi River Alluvial Plain. At this point, the streams were slowed markedly and dropped the largest part of their sediment load. At a later date, after many changes of course, the two rivers, in shortening their courses, both entered the Mississippi, more or less abruptly instead of paralleling it. This resulted in the formation of two separate cone units as sediments were left stranded along the old channel courses. The larger of these units, formed by the Arkansas, is located in the northeastern part of the State and is commonly known as the Macon Ridge Area. It is quite extensive and makes up all or significant parts of the parishes of Morehouse, Ouachita, West Carroll, Richland, Franklin, Caldwell, and Union. (See map, Fig. 1). The Red River Cone Unit forms a belt across Rapides Parish and terminates in Avoyelles and St. Landry. Approximately 30 per cent of each of the three parishes is made up by this cone unit.

Topographically, these areas are flat to gently rolling and are distinguished from the Mississippi River Alluvial Plain primarily by their reddish soils and the higher elevations of the areas. Altitudes range, in general, from 35 to 75 feet in the Red River Cone Units and from 50 to 100 feet in the Arkansas Cone Unit.

The soils of these two areas are Red River bottom soils of the Miller type in the Red River Unit and light brown to gray loessial Mississippi Bluff and Terrace soils, primarily of the Oliver type, in the Arkansas Cone Unit. In general, these two areas have rich, easily tilled soils and are two of the most extensively farmed areas of the State. (Fig. 2).

Originally, these areas did not support heavy forest growth, but were open meadow lands interspersed by clumps of mixed hardwoods and strips of forest along streams. At present, these units are predominately farming areas and are, for the most part, under cultivation. From a game standpoint, the areas are primarily farm game areas and where cover is available they produce some of the highest quail populations in the State. Modern methods of farming, however, have seriously affected the quail, rabbit, and dove populations in many parts of these areas. Potentially, the fertility of the soils in these two sections offers excellent prospects for farm game, if provisions can be introduced into the farming structure to care for some of the game habitat.

THE MISSISSIPPI ALLUVIAL PLAIN UNIT AND THE DELTAIC PLAIN UNITS

The most recent formations in Louisiana are the Alluvial Plain Unit of the Mississippi River and the Deltaic Plain. The Mississippi Alluvial Plain extends from the Arkansas line as far south as Iberville and St. Martin Parishes and includes all or part of 14 river parishes. (Fig. 1). The Deltaic Unit parallels the Gulf Coast from Mississippi to Texas and includes all or parts of 15 coastal parishes.

Topographically, both of these areas are flat, sloping to the south at a rate measured in tenths of a foot to the mile. The only noticeable relief is that between the tops of natural levees and the intervening scars between levees. Elevation in the Mississippi Alluvial Plain ranges from 5 feet in the south to 100 feet at the north edge. The Deltaic Unit is flat and at sea level or below the only relief afforded is by the crests of natural levees.

The Mississippi Alluvial Plain Unit has several characteristics which make it a distinctive unit. It includes all the recent surfaces along the Mississippi River except the cone units described above. (Fig. 1). The area is well marked by old channel scars of the Mississippi River which appear as low, swampy areas or low lands between the higher natural levees once formed on each side of the channel. A large part of this area is subject to periodic inundation from back waters of the Mississippi and its tributaries. (See map, Fig. 5). The soils of the area are characteristic dark brown to gray Mississippi River bottom soils of the Sharkey, Sarpy, Waverly, and Portland types. (Fig. 2). These soils are heavy and hard to till on the better drained areas but are highly productive and have resulted in much of the area being farmed.

Most of the area in early times was clothed in a dense forest of bottomland hardwoods with an almost impassable understory of switch cane and palmetto. The timber ranged in type from red gum and oaks, overcup oak, and bitter pecan in the north to the vast cypress-tupelo swamps in the southern portion. At the present time, much of the area is farmed because of the high fertility of the soil. Since the best drained and lighter soils are on the crests of natural levees, the roads and settlements also occur on the crests while the farm lands extend from the natural levees back to the swamp or timbered areas where drainage has proved too poor to support agriculture. Much of the area, therefore, remains in large second-growth bottomland hardwood forests which form strips between the farmed areas on the higher levees. In some parts of the southern section, the lowlands expand and the forests are vast swamps of cut-over cypress-tupelo gum and related types.

The Deltaic Plain Unit is characterized by its extremely flat and low topography. In general, the only places not subject to overflow are the crests of natural levees. Much of the area is inundated

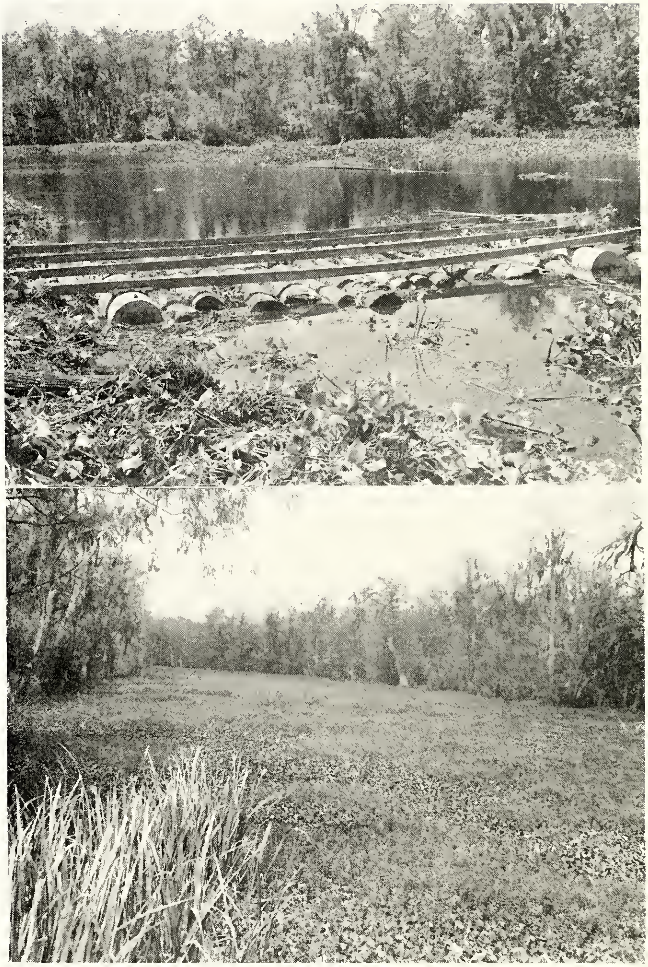


PLATE 1

Two views of a typical cut-over cypress-tupelo swamp type deer range in summer. Note the water hyacinth and alligator grass blanketing the water areas. These aquatics are reducing the waterfowl areas. The alligator grass is used by deer.

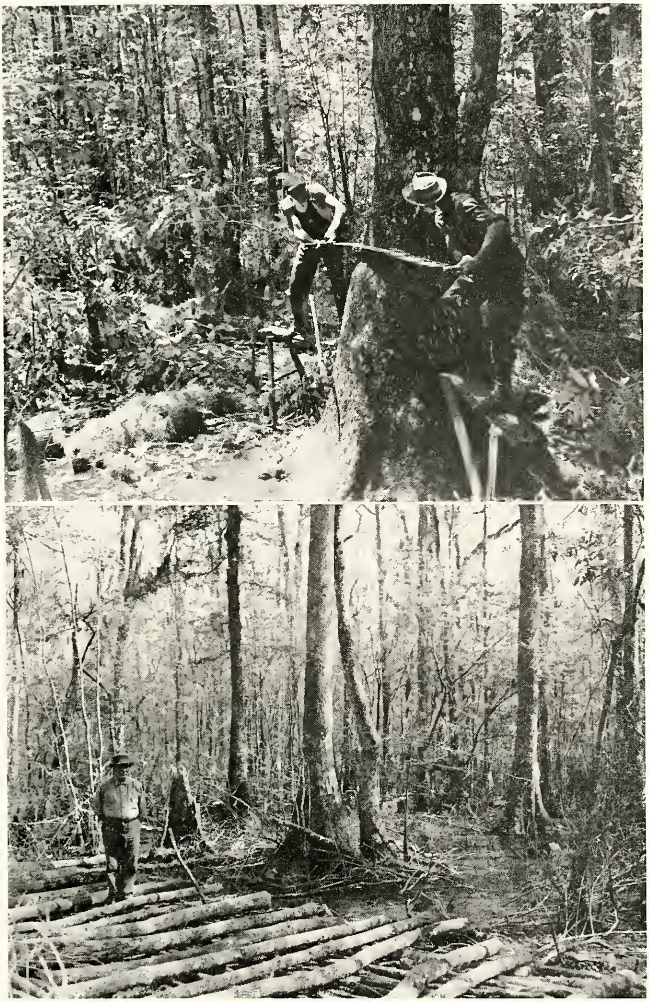


PLATE 2
Close-up views of interior of tupelo swamp. The winter aspect (bottom) indicates an apparent lack of browse, yet such areas support good deer populations.

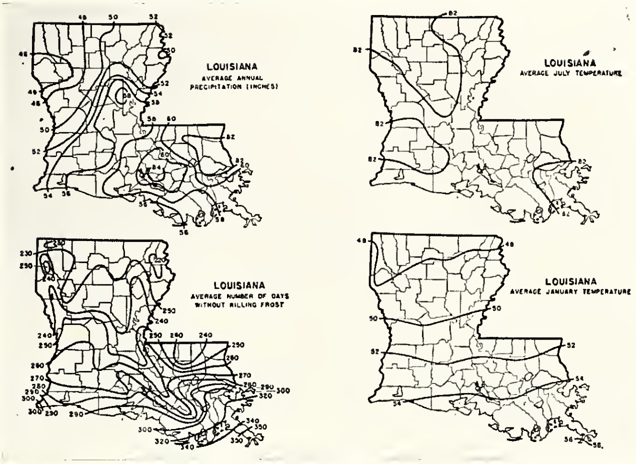
and subject to the effects of salt water tides. This area is marked by its vast marsh areas, ghost cypress swamps caused by subsidence, and high land confined to the crests of natural levees and chenieres which are old beach formations.

These two units with their vast areas of second-growth hardwoods and cypress-tupelo swamp have been the salvation of Louisiana's deer, bear, turkey, and fur production. These were the only areas where forest game could survive in the face of man's destruction of range by lumbering and his subsequent unrelenting slaughter of the game which was forced to occupy smaller ranges. At one time, the vast plantations of the area produced much farm game, but in recent years new methods of farming and the increase of livestock farming have reduced this type of game in these areas. The area with its swamp and marshlands contains nearly all of the waterfowl wintering range in the State and probably the best and largest amount of such range in the United States.

CLIMATE AND ITS EFFECT ON GAME

Louisiana's geographical position between latitude 29.5° and 33° north which places it in a sub-tropical location and its proximity to the Gulf of Mexico are the primary influences which determine the climate of the state. Prevailing southerly winds in summer cause the climate to be moist and somewhat tropical. Such southerly winds and ocean high pressure areas are conducive to afternoon thunder showers. When high pressure areas occur to the west of Louisiana, westerly and northerly winds with a hotter, dryer condition occur during the summer months. In winter months, the cold continental air masses are somewhat moderated and controlled by the warm tropical air coming in from the gulf. This results in a series of alternating warm wet and cold dry spells during most of the winter. Advancing cold fronts meeting warm air in the area of Louisiana result in short periodic squalls followed by clearing cold or cooler weather. When such cold fronts enter the State in rapid succession, temperatures may drop to as low as 5° to 15°F. in the northern part of the State and as low as 20°F. in the southern part of the State. It is at such times that snow, sleet, and icing may occur in the State.

The climatic tables and maps (Figs. 3 and 4) show the general climatic summary for the past 40 years. The average


LOUISIANA
AVERAGE ANNUAL PRECIPITATION (INCHES)
LOUISIANA
AVERAGE JULY TEMPERATURE
LOUISIANA
AVERAGE NUMBER OF DAYS WITHOUT KILLING FROST
LOUISIANA
AVERAGE JANUARY TEMPERATURE

FIGURES 3 AND 4.

annual temperature in Louisiana ranges from 64.1° at Farmerville in north Louisiana to 70.8° at Burrwood at the tip of the Delta. The hottest monthly average is 83° during August at Burrwood and the coldest, 46.3° during January at Plain Dealing in north Louisiana. First killing frosts in fall usually occur around November 1 in the northern part of the State and as late as December 14 in the extreme southeastern part of the State. The average dates of the last killing frost in the spring are February 1 in the south and March 28 in the northern parishes. The annual growing season ranges between 320 days on the coast to 220 days in the extreme northern part of the State. Annual rainfall ranges from 47 inches in the northwestern part of the State to 62 inches just north of Lake Pontchartrain in the Florida Parishes. (Fig. 4).

As a whole, Louisiana's climate must be described as very mild and stable, with few hurricanes, droughts, floods, snows, tornadoes, or other drastic occurrences that would markedly control or affect game populations over long periods of time. On the other hand, it is extremes of climate that affect game and, although such extremes are of short duration when they occur, it is well to be able to recognize their effect on game so that proper protection during and after such periods can be established.

TABLE 1

CLIMATIC SUMMARY

PARISH*	TEMPERATURE					KILLING FROST AVERAGE DATES				
	Length of record	January average	July average	Maximum	Minimum	Length of record	Last in Spring	First in Fall	Growing season**	Annual Rainfall
	Yr.	°F.	°F.	°F.	°F.	Yr.			Days	In.
Acadia	29	54.2	82.0	103	9	29	Feb. 17	Nov. 24	280	54.93
Allen	38	51.8	82.1	106	5	39	Mar. 3	Nov. 22	264	57.26
Ascension	40	54.0	82.1	109	3	40	Feb. 26	Nov. 29	276	58.49
Assumption	....	......	......	......	....	....	....	....	......	52.59
Avoyelles	....	......	......	......	....	....	....	....	......	57.14
Beauregard	18	52.5	82.8	106	9	18	Mar. 7	Nov. 20	258	54.15
Bienville	29	48.9	82.7	112	–6	29	Apr. 15	Oct. 31	199	50.10
Bossier	40	46.3	82.1	114	–14	40	Mar. 28	Nov. 5	222	47.89
Caddo	40	47.0	83.2	110	–5	40	Mar. 8	Nov. 15	252	41.64
Calcasieu	39	52.0	82.5	106	3	39	Mar. 3	Nov. 23	265	56.72
Cameron	34	53.9	82.5	103	13	34	Feb. 7	....do......	298	56.34
DeSoto	40	47.4	81.7	110	–6	32	Mar. 12	Nov. 8	241	45.62
E. Baton Rouge	40	53.1	81.7	110	2	40	Feb. 24	Nov. 20	269	58.19
E. Carroll	16	47.7	82.5	109	–4	16	Mar. 20	Nov. 10	235	50.38
E. Feliciana	33	50.1	80.4	103	0	34	Mar. 11	Nov. 12	246	58.30
Evangeline	13	53.5	82.8	107	15	13	....	....	......	57.41
Franklin	13	50.2	82.6	106	8	13	Mar. 4	Nov. 7	248	51.29
Iberia	24	54.3	81.9	104	3	24	Mar. 4	Nov. 20	261	56.35
Jefferson	....	......	......	......	....	....	....	....	......	54.35
Jeff. Davis	40	53.0	82.1	105	3	40	Feb. 27	Nov. 20	266	55.64
Lafayette	40	53.1	81.6	107	6	40	Mar. 3	Nov. 14	256	57.37
Lafourche	23	55.1	80.5	101	16	22	Mar. 1	Nov. 27	271	59.48
LaSalle	12	48.0	81.0	110	3	12	....	....	......	51.87
Lincoln	38	48.0	82.3	108	–5	38	Mar. 16	Nov. 14	243	49.54
Madison	25	48.8	81.6	105	2	24	Mar. 20	Oct. 27	221	48.90
Morehouse	17	48.3	82.0	107	9	17	Mar. 26	Oct. 31	219	53.30
Natchitoches	40	48.6	81.7	110	–6	40	Mar. 24	Oct. 31	221	48.35
Orleans	40	53.5	80.1	102	7	40	Feb. 20	Dec. 9	292	59.72
Ouachita	40	47.2	81.5	110	–13	39	Mar. 23	Nov. 6	228	50.88
Plaquemines	30	57.1	82.6	99	10	30	Jan. 11	Dec. 30	353	57.31
Rapides	40	51.1	81.9	108	3	38	Mar. 9	Nov. 11	247	56.95
St. Charles	....	......	......	......	....	....	....	....	......	60.12
St. John	38	53.7	82.5	107	16	38	Feb. 22	Nov. 28	279	57.93
St. Landry	40	53.4	81.7	107	2	40	Feb. 27	Nov. 27	273	57.16
St. Martin	....	......	......	101	7	....	....	....	......	54.29
St. Mary	40	53.7	82.0	104	8	40	Feb. 20	Dec. 2	285	63.29
St. Tammany	38	52.2	81.5	105	9	38	Mar. 4	Nov. 24	265	62.07
Tangipahoa	40	51.3	80.9	105	1	40	Mar. 18	Nov. 6	233	64.37
Tensas	....	......	......	......	....	....	....	....	......	52.83
Terrebonne	40	54.8	81.6	104	5	39	Mar. 1	Nov. 12	256	59.31
Union	24	46.5	81.1	108	–15	24	Mar. 28	Nov. 1	218	51.93
Vermilion	37	53.5	81.6	105	5	38	Mar. 1	Nov. 21	265	56.48
Vernon	18	49.9	80.9	106	9	18	Mar. 12	Nov. 8	241	51.36
Washington	26	51.0	81.3	104	10	25	Mar. 11	Nov. 14	248	60.41
Webster	40	47.2	82.1	112	–16	39	Mar. 24	Nov. 9	230	48.95
W. Baton Rouge	28	52.8	81.6	103	11	28	Mar. 4	Nov. 19	260	60.33
W. Feliciana	23	51.2	82.6	104	8	23	Mar. 6	Nov. 22	261	54.91
Winn	30	50.1	83.3	110	3	30	Mar. 21	Nov. 12	236	51.44

* Parishes not listed have no weather station.

** Length of growing season between average dates of last killing frost in spring and first in fall.

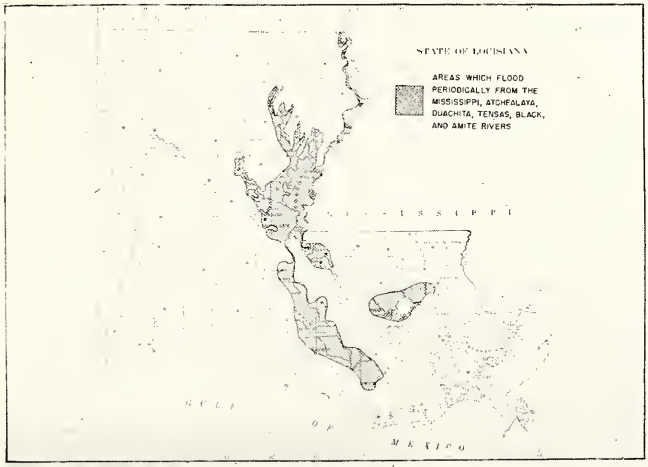

STATE OF LOUISIANA
AREAS WHICH FLOOD PERIODICALLY FROM THE MISSISSIPPI, ATCHAFALAYA, OUACHITA, TENSAS, BLACK, AND AMITE RIVERS
MISSISSIPPI
GULF
OF
MEXICO

FIGURE 5.

Perhaps rainfall and the accompanying flooding cause damage more frequently than any other climatic extremes. Heavy rainfalls, both in and out of the State, may have a marked effect on the game in Louisiana particularly the deer and large forest species. Much of Louisiana's best and most heavily populated deer range is subject to periodic flooding, usually in the spring of the year. The back waters of the Mississippi, Red and Atchafalaya Rivers accompanied by local heavy rains, periodically flood the lower Tensas Basin and the Atchafalaya Basin. Local heavy rains coupled with high wind tides in Lake Maurepas and the lower Amite River system periodically flood the Blind River swamp area. (Fig. 5). These areas represent the greatest portion of Louisiana's occupied deer range. (Fig. 6). At such times, deer are crowded onto ridges and swamp edges where poaching and illegal night shooting become almost uncontrollable. This coupled with the loss of fawns that occurs when they are dropped during flood periods represents common losses in bottomland deer herds. (See Plate 4).

Other ways in which excessive rainfall damages game are when as much as 5 to 10 inches may fall in from 24 to 72 hours; or, when heavy rains cause the average for a short period of a month

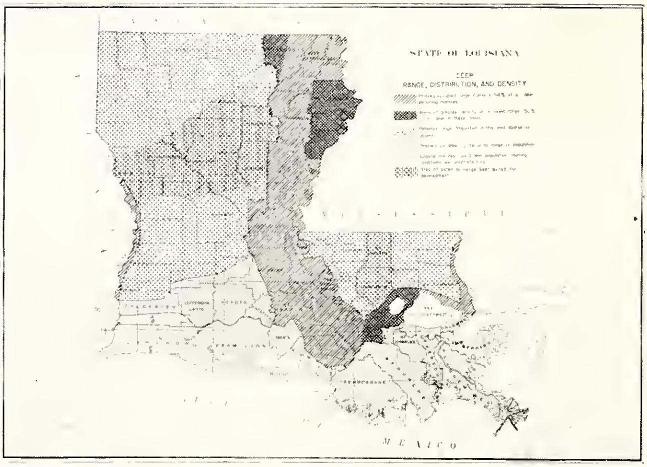


FIGURE 6.

or so to far exceed the normal. When either happens during the nesting seasons of quail and dove, vast numbers of nests and young birds are lost.

Severe droughts, on the other hand, are perhaps less frequent than flooding in Louisiana. The species most likely to be affected are the fur bearers and waterfowl. A recent study of the muskrat indicates that extreme droughts are quite detrimental to its annual production. Quail and other seed-eating birds are indirectly affected by a loss of food in dry years, and, in rare cases, hatching may be prevented. Findings on quail investigations indicate that the young-old ratio may drop quite low after long, dry summers. Whether this is caused by a loss of young from a lack of food or by a failure of the eggs to hatch, or a combination of the two is not known. Forest and grass fires as a secondary effect of drought are, of course, also detrimental to wildlife.

Winter extremes have perhaps the least harmful climatic effect in Louisiana only because they are infrequent. Between 1946 and 1950, only twice have snow and sleet covered the ground enough to affect wildlife. In each instance, a marked change was noted. Quail weights show considerable decline if snow stays on the ground more than a few days. Such weakened birds are subject to predation and disease as well as to some loss directly from the cold. Dove, woodcock, and snipe also suffer considerably at such times—doves from starvation and freezing, woodcock and snipe from starvation, freezing, and occasional illegal kills by man.

In final analysis, the climate of Louisiana should be considered as generally ideal for game, but the effect of periodic climatic extremes should be noted and protection should be given game during and shortly after such times.

POPULATION

In studying the effect of human population density and fluctuations on game conditions, there are two primary points that should be considered. One is the direct effect of crowding game populations by the increase in humans and their settlement, and the other is the effect of increased hunting pressure as a result of human population increases. Following is an analysis of the major changes in Louisiana's population as it affected game between the years 1900 and 1950.

The human population in Louisiana in 1900 was 1,381,625 of which 73.5%, or 1,008,586, lived in rural areas. Excluding the people living in towns and cities, there were approximately 22 humans per sq. mile of area. By 1950, the total population of Louisiana had increased to 2,363,880 or nearly double that of 1900. The percentage of people living in rural areas, however, dropped from 73.5% in 1900 to 58.0% in 1950. This means that the rural population of 1950 was 1,371,050 or approximately 30 persons per sq. mile. It is evident from this, that, although the total population in Louisiana increased nearly 100% in a 50-year period, the effect on game from crowding by humans has been somewhat less than might be expected since the increase in human population density in rural areas was only 36%.

The reaction of the general public and of many game management experts is to judge total hunting pressure in a direct ratio to total hunting license sales in a given area. This system may be applicable in many areas, but it is the opinion of this investigator that, in Louisiana at least, there are so many exceptions to using such figures, it would be difficult to assess accurately the true hunting pressure picture, unless the changes in human population were used as the basis for judgment. For example, the sale of licenses in Louisiana was not a part of the game conservation picture until after 1912;

and for many years a strong objection on the part of the public toward licensing hunters resulted in far less than the total number of hunters being licensed. Furthermore, since the progress toward acceptance by the public was slow and enforcement of the law lax, it is believed that only quite recently have the license sales in Louisiana even begun to approximate the total number of potential hunters of the State. Since this is the case, published figures showing that from 50,000 to 70,000 licenses were sold in 1915-19 are not believed to indicate the total potential hunters in the State at that time and when contrasted to present hunting license sales gives an erroneous impression of a great increase in hunting pressure since then.

At the present time, about 200,000 hunters buy licenses annually. This represents approximately 30 per cent of all males between the ages of 15 and 60 and probably represents the bulk of the potential hunters in the State, since, by 1950, most of the hunters had been educated toward buying a license. If this same percentage ratio is applied to the total male population between the ages of 15 and 60 in 1900, we find that the potential hunting population at that time was approximately 124,000 which is a substantially greater hunting population in 1900 than records would seem to indicate. The total population increase since 1900 indicates that the hunting pressure increase has been only about 50 per cent which, of course, is contrary to the popular belief that this pressure has increased many times in the past 50 years. A more critical analysis of the hunting pressure when other factors are considered along with the total number of potential hunters would indicate that the actual pressure on game per unit area has actually changed very little in the past 50 years. For example, 125,000 hunters in 1900 with a season of 120 days or more, no bag limit and more areas available to hunt, probably produced as much or more pressure per unit area than do 200,000 hunters in 1950 with less than half the season length, much smaller bag limits, and more land unavailable for hunting because of posting. In all probability, the longer seasons and the fact that more hunters lived in rural areas, the actual man-days hunted in 1900 far exceed that of 1950.

It is the considered opinion of this investigator, as will be discussed more fully in other parts of this report, that hunting pressure or changes in human population, at least since 1900, have not been too significant in lessening Louisiana's game supply.

A GENERAL HISTORY AND DESCRIPTION OF GAME RANGE IN LOUISIANA FROM 1700 TO 1950

In order to understand the game conditions in Louisiana at the present time and in order to devise efficient and economically sound management procedures for the restoration and maintenance of proper game conditions, it is of vital importance to know how the present situation evolved. Unless the causes behind the changes in game conditions are known, there is little hope of ever producing a stable, well managed game supply in the State.

An examination of the history of game in all areas studied in the United States thus far, indicates that changes in game conditions are tied in with the history of the areas in question and particularly with changes in forest and farm lands, with industrialization, and with fluctuating human populations in the area. In other words, the land use pattern has governed the game picture more than any other single factor. In this section of the report, an attempt is made to describe as accurately as possible Louisiana's game ranges and species as early as records are available to give a short, general description of the present conditions for comparative purposes, and to make a step by step analysis of the causes and basic changes that have brought about these later conditions.

ORIGINAL GAME CONDITIONS IN LOUISIANA

GAME HABITAT:

Any attempt to describe accurately the game conditions of Louisiana as the first white man found them might be considered hopeless since most of the histories of the State fail to do more than barely mention wild game. A search of the literature, however, does bring to light the writings of a few early travelers, historians, and naturalists who give us a rather broad picture of game conditions in the early days. DuPratz (1758), writing about his travels in Louisiana between 1718 and 1734, gives us an unusually vivid picture of the game habitat as he saw it. His description of the kinds and distribution of types is good. DuPratz's observations on game populations are probably questionable except in his description of extremes of abundance or rarity.

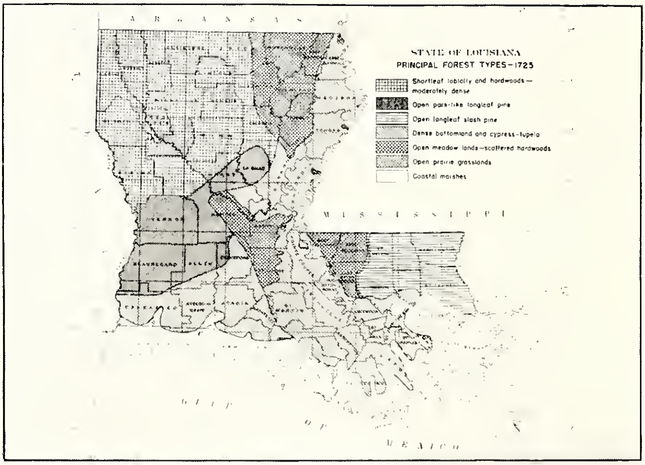

ARKANSAS
STATE OF LOUISIANA
PRINCIPAL FOREST TYPES—1725
Shortleaf loblolly and hardwoods—moderately dense
Open park-like longleaf pine
Open longleaf slash pine
Dense bottomland and cypress-tupelo
Open meadow lands—scattered hardwoods
Open prairie grasslands
Coastal marshes
MISSISSIPPI
GULF OF MEXICO

FIGURE 7.

Audubon and other naturalists studied at an early enough date to verify most of the species reported by earlier writers.

Perhaps the most striking thing reported about Louisiana by early visitors was the arrangement and general productivity of the forests, prairies, and meadows. It also is interesting to note that these first explorers recognized the relative merits of different parts of the State. Contrary to popular belief, Louisiana was not covered by a solid forest. Apparently, many large areas besides the natural prairies of southwest Louisiana were open meadow type lands. Whether these open meadow lands were natural or the result of fires set by the Indians is not clear. Early writers speak of the annual, almost ritualistic fall burning of the grasslands by the Indians. This practice carried on for many years may have well prevented the formation of a climax hardwood forest. These meadows contained scattered patches of hardwoods which dotted the grasslands and formed strips along the streams. This type of condition existed in the areas between the Amite and Mississippi Rivers, north of Bayou Manchac; between the Ouachita and Tensas Rivers; and in the vicinity of Avoyelles, St. Landry, and southeastern Rapides Parishes. (Fig. 7). Such areas apparently were confined to the alluvial cone units described earlier and to the better bluff and terrance soils of the Western Florida Parishes.

The remainder of Louisiana, excepting the marshlands and the southwest Louisiana prairies, was virtually solid forest lands. (Fig. 7). The northwest Louisiana hill lands were clothed in a pine-hardwood forest with short leaf, longleaf, and loblolly pine forming the major part of the stand. The understory was semi-park like, but well supplied with shrubs, young hardwoods, and other foods suitable for game. The streams and bottoms throughout this area were more thickly grown up in hardwoods. The early settlers recognized this area as suitable for settlement but noted it to be less productive than the open meadows and alluvial areas.

The alluvial lands along the Mississippi River and bordering the coastal marshes were apparently covered by a dense growth of climax hardwoods with an almost impassable under-story of switch cane (*Arundinaria tecta* and *A. gigantea*) and palmetto (*Sabal minor*). In the lower regions of the State and bordering the coastal marshes in the southeast, the early explorers found vast cypress-tupelo swamps that were flooded annually because man-made levees were not in existence to protect this area from the high waters of the Mississippi. The very first settlers considered most of this alluvial land too wet to cultivate but they knew that the light, better drained soils on the crests of natural levees were extremely fertile. This fact, plus ease of transportation by water, led eventually to the growth of the large plantations along the river.

The long leaf pine forests which covered most of the terrace lands in Louisiana and which were more or less continuous with the southeastern coastal pine belt presented to the early traveler a solid park-like stand of majestic pines. The under-story was clean and except for the shrubs and small hardwoods along the small creeks offered little food for game. DuPratz and other explorers looked upon this great pine area as sterile and valueless because the virgin pine forest and poor sandy soils were not considered to be productive enough of game or crops to maintain settlement. The coastal marshes and parts of the western prairies of Louisiana are not well described because early explorers considered them not suitable to sustain settlement and therefore did not visit them.

TABLE 2

GAME TYPES, RELATIVE ABUNDANCE, AND DISTRIBUTION

1725 as compared to 1950

SPECIES	ABUNDANCE 1725	DISTRIBUTION–1725	ABUNDANCE 1950	DISTRIBUTION–1950
Buffalo *(Bison bison)*	Moderate	Over most of La. More prominent on grasslands and meadows, did not penetrate dense woods.	Absent	
Elk *(Cervus canadensis)*	Moderate	Of questionable range in La. Reported only in heavy forest.	Absent	
White Tailed Deer *(Odocoileus virginianus)*[1]	Very abundant	Ranged over entire state. Most abundant in open forest and grasslands.	Plentiful	Primarily in Miss. & Atchafalaya bottomlands. Becoming more common in mixed pine-hardwood areas where protected.
Black Bear *(Euarctos luteolus)*	Numerous in winter	Primarily confined to switch-cane thickets of Mississippi River bottomland forest.	Very few	Dense bottomland forests of Tensas and Madison and the lower Atchafalaya bottomland areas.
Cougar *(Felis concolor coryi)*	Occasional	Found where deer and other types of prey were most abundant.	Extremely rare	Confined to heavily wooded areas of N. E. and Central La.
Bobcat *(Lynx rufus floridanus)*[2]	Seen occasionally	Probably ranged over entire state where food was available.	Common	In most densely wooded areas.
Wolf *(Canis niger gregoryi)*	Plentiful	Followed game and hunting parties, fed on offal and small game.	Rare	Scattered in densely wooded hill and high bottom areas.

Fox *(Urocyon cinereo argenteus floridanus)*[3]	Numerous	Confined to hill lands.	Abundant	Over entire highlands of State. More plentiful in pine-hardwood hill areas.
Raccoon *(Procyon lotor varius)*[4]	Numerous	Most occurred in bottomland areas, but probably some over entire State.	Abundant	Over entire State.
Opossum *(Didelphis virginiana)*[5]	Numerous	Most occurred in bottomland areas, but probably some over entire State.	Abundant	Over entire State.
Muskrat *(Ondatra zibethicus rivalicius)*	Not reported	If present, confined to coastal marshes.	Very abundant	Confined to coastal marshes and associated lowlands.
Beaver *(Castor canadensis carolinensis)*	Moderate	Confined to streams not subject to extreme flooding.	Occasional to common in certain areas	Confined primarily to rivers and streams of Fla. Parishes.
Otter *(Lutra canadensis texensis)*	Reported few seen	Most aquatic swamp areas.	Sparse	Swamp areas of S. E. La. and the Atchafalaya and Mississippi bottoms.
Mink *(Mustela vision vulgivaga)*	Abundant ?	Most aquatic swamp areas.	Common on suitable range	Primarily same as otter — but found occasionally over entire State.
Skunk *(Mephitis mephitis)*[6]	Abundant ?	Over most of dryer areas of State.	Abundant	State-wide.
Squirrel *(Sciurus spp.)*[7]	Very abundant	Predominate in hardwood and mixed pine-hardwood areas.	Plentiful	State-wide in forest lands.
Rabbit *(Sylvilagus spp.)*[8]	Plentiful	Reported over entire State.	Plentiful	State-wide.
Wild Turkey *(Meleagris gallopavo silvestris)*	Very abundant	Most high lands of State in mixed forest areas.	Rare to uncommon	Primarily confined to Fla. Parishes and Tensas, Madison area. Being introduced in most heavily forested areas of State.
Prairie chicken *(Tympanuchus cupido)*	Plentiful	Open meadows and prairies.	Absent	

TABLE 2—(Continued)

GAME TYPES, RELATIVE ABUNDANCE, AND DISTRIBUTION

1725 as compared to 1950

SPECIES	ABUNDANCE 1725	DISTRIBUTION—1725	ABUNDANCE 1950	DISTRIBUTION—1950
Quail *(Colinus virginanus virginianus)*[9]	Rare, few seen	Confined to inhabited areas, and open land.	Common to plentiful	All farm lands and cut-over pine lands.
Meadowlark *(Sturnella magna)*[9]	Common	Open lands.	Abundant	All open land.
Mourning Dove *(Zenaidura macroura carolinensis)*	Very few seen	Open and cultivated areas.	Common to plentiful	Farm lands, open lands, and open woods.
Passenger Pigeon *(Ectopistes Migratorius)*	Extremely abundant	Used all mast producing forests and cultivated lands. Caused great damage to trees and crops.	Absent	
Woodcock *(Philohela minor)*[9]	Common	Not distinguished or clearly reported in early literature. Probably very numerous in suitable ranges like open wet meadows, and damp forest areas.	Common in certain areas	Wetter hardwood areas of Miss., Atchafalaya system, creek bottoms of pine land.
Wilson Snipe *(Capello galinago)*[9]	Common		Becoming more common	Marshes and wet meadows.
Upland Plover *(Bartramia Longicauda)*[9]	Common		Occasional to rare	
Swans *(Cygninae)*[10]	Common	Confined to waters and marsh.	Absent	
Cranes *(Gruidae)*[11]	Common	Confined to waters and marsh.	Absent	
Geese *(Anserinae)*[12]	Abundant	Confined to waters and marsh.	Common	Primarily in marshes.

Ducks *(Anatidae and Fuliguli-nae)*[12]	Very abundant	Confined to waters and marsh.	Common	In all aquatic areas — primarily swamps, lakes, and marshes.
Wood Ducks *(Aix sponsa)*	Very abundant	Confined to waters and marsh.	Plentiful	In all aquatic areas — primarily swamps, lakes, and marshes.
Spoonbill *(Ajaia ajaja)*	Common	Confined to waters and marsh.	Occasional to rare	

[1] Two races of deer range in State—*O.v. louisianae* and *O.v. mcilhennyi.*

[2] Two races of lynx range in State—*L.r. floridanus* and *L.r. texensis.*

[3] The red fox *Vulpes fulva* is not native to La. but has been introduced in recent years.

[4] Two races in State—*P.l. varius* and *P.l. megalodous.*

[5] Two races in State—*D.v. virginiana* and *D.v. pigra.*

[6] Three skunks in Louisiana—two striped skunks *M.m. elongata* and *M.m. mesomelas* and the spotted skunk *Spilogale indianola.*

[7] Five races of squirrel in State—two grey squirrels, *S. carolinensis carolinensis* and *S.c. fuliginosus*, and three fox squirrels—*S. niger bachmani, S.n. subauratus*, and *S.n. ludovicianus.*

[8] Three races of rabbits—the cottontail *S. floridanus alacer* and two swamp rabbits, *S. aquaticus aquaticus* and *S.a. littoralis.*

[9] The identification of these three birds not clear from early writings.

[10] Two swans originally in State—*Cygnus columbianus*, the whistling swan and *C. buccinator*, the trumpeter.

[11] Two true cranes in State—originally, early writers may have been referring to herons as well.

[12] Thirty-five or more species of ducks and geese use the State as a wintering range.

Early Game Types, Their Distribution and Abundance As Compared With the Present

In attempting to describe early game types, a decision must be made as to what types constitute game and which are the non-game types. For the purpose of this discussion, all types that were taken by man for food or clothing and those types seriously hunted as predators are considered as game.

Table 2 is a listing of the game types reported in 1700 as compared with the same species today. Early abundance and distribution was determined as completely as possible from available literature, but it is doubtful if the observations in some cases were sound, particularly, in regard to abundance of the species recorded. Early observers based descriptions of abundance and rarity in a great many cases on the relative amount of one species as compared with another or else they compared estimates with European conditions rather than basing these estimates on a density per unit area standard. For example, bobcat, otter, cougar, and quail are all reported to be rare or only occasional, by observers. This may have been true for the quail which had little range, but the range of the other three species was extensive and excellent. More likely, these reports resulted from the fact that these animals were extremely wary or few in number when compared to other species. On the other hand, the term abundance used by early writers was obviously a direct comparison of Louisiana's game supply with that of Europe where game was probably already scarce. It is obvious that the terminology as used here and in any of the literature must be purely relative. Later in this discussion, a comparison of early and present-day populations based on range carrying capacity will be offered.

The species as listed in Table 2 may be broken down into four major groups as follows:

1. Species that once ranged in the State and are now extinct or absent from the area. In this group are the buffalo, elk, greater prairie chicken (Att water), and passenger pigeon. The buffalo, at one time, apparently ranged over most of Louisiana in considerable numbers. Early writers report it in the vicinity of New Orleans and Baton Rouge around 1700 and it was reported at various times in the open lands west of the Mississippi River. The bison was reported to shun dense, forested areas which would indicate that those reported east of the Mississippi must have come down from what are now the States of Mississippi and Tennessee and did not cross the dense bottomland forests along the lower Mississippi River or the river itself. Apparently, the buffalo could not survive civilization and extreme hunting pressure. It was rapidly driven out of Louisiana. Lowery (1943), from a study of the literature, reported that the last one was killed near the present site of Monroe, Louisiana, in 1803.

There is no authentic evidence that elk ever occurred in Louisiana. DuPratz reported it on several occasions between 1718-1735 in the denser forests of the higher lands of Louisiana. His observations could have well been made in what is now the State of Arkansas or even as far north as Missouri since he traveled widely. Anthony (1935) reports the original range of the elk to be between the 35th. and 50th. parallels. This would place the range out of the present boundary of the State of Louisiana, but it is conceivable that elk may have occurred in northern Louisiana.

The prairie chicken ranged in goodly numbers over the prairies of western Louisiana. Probably, it also occurred in the meadowlands east of the Mississippi and in the vicinity of the Macon Ridge. (Fig. 7). This fine game bird was finally driven from the prairies of Louisiana by advancing civilization and market hunting in the early part of the twentieth century. The last bird authentically reported in the State was seen in Cameron Parish in 1919 by A. M. Bailey. (Bailey and Wright, 1931).

Stories of the passenger pigeon in Louisiana, as well as over the central part of the United States, are numerous. Apparently, the early settlers saw such great numbers of these birds that it staggered their imagination and left them at a loss for a description suitable for the spectacle. There is ample evidence that the great numbers of pigeons that arrived in the fall would literally strip miles of mast-producing forests and grain crops of all the available food. These birds disappeared from Louisiana as the national population was eliminated by destruction at their nesting sites, mass killing and trapping, and, finally, by the loss of habitat as a result of the advance of civilization.

2. Species once numerous to common in the State now rare, sparse, or protected: In this group are the cougar, bear, wolf, beaver, otter, wild turkey, snipe, upland plover, swans, and cranes. The cougar, bear, and wolf were common in early days. Bear were particularly numerous in dense hardwoods along the Mississippi and other streams. According to DuPratz, they were more abundant in winter since they were driven south ahead of the early snows before hibernation! Cougar and wolves were found in areas where game that they preyed on was plentiful. Cougar apparently were never very numerous or else they did not remain in the vicinity of habitation for long. Wolves followed the hunting parties and fed on the offal. Beaver and otter, once fairly plentiful, were found in most aquatic areas of the State. They remained plentiful until heavy trapping for the market and a great reduction in suitable range reduced their numbers to very few.

Turkey,* upland plover, and snipe* all were much-sought-after game birds for the market, for home consumption, and for sport. The turkey ranged over most of the forests of Louisiana except the wetter swamps, while snipe and plover were confined to wet meadows, pastures, and prairies. Heavy gun pressure on these fine game birds coupled with great range reduction in the case of the turkey and the effect of severe winter weather on the shorebirds has reduced their numbers in the State so that they have been removed from the list of huntable game.*

Swans and cranes, once common among the myriads of waterfowl, are now extremely rare in the State. Most of them were eliminated by the early part of the twentieth century.

All of the species in this group still occur in the State to some extent and many offer a good potential for building up huntable populations. These will be discussed in detail later in the report.

3. Species now taken only for fur or because of predation: This group includes the bobcat, fox, beaver*, raccoon, opossum, muskrat, mink, and skunks. All of these species, with the exception of the muskrat, were numerous in early times. For the most part, they ranged over the entire State, but the most dense populations naturally were centered in the type habitat best suited to the species. For example, the aquatic or semi-aquatic forms like mink, muskrat, otter, beaver, and raccoon were no doubt more common in southern Louisiana and along the river and stream courses. High land types were probably more numerous in the less dense dry hill forest. Although it is generally assumed that all of these animals were taken for fur in early times, most of the evidence points to the fact that the larger types like bear, buffalo, deer, fox and beaver were in the greatest demand. The small types apparently were not molested much until fur began to be a luxury rather than a necessary part of clothing. For the most part, the populations of the smaller fur types remained high until near the end of the nineteenth century when the ranges of these animals were greatly reduced by timber operations, drainage, and farming and when the demand for luxury furs reached a peak. At present, all of this group except beaver and otter still exist in reasonable numbers on the remaining range. The muskrat is the sole exception to this general picture of the fur animal. It is not reported at all by early writers. Studies by O'Neil in 1949 indicate that muskrat may not have been in Louisiana much before 1850. At the present time, the animal is confined in this State primarily to the coastal areas. It is our most abundant fur producer and the mainstay of the entire fur industry of the United States.

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*Snipe & turkey have since been placed back on the list of huntable game.

*Included in groups two and three because they are fur bearers as well as rare.

4. Species that are still hunted as game: Under this heading, we have those game species that have been able to survive the coming of civilization, changes in range, and much hunting pressure and still remain numerous enough on the available range to furnish reasonably successful hunting. In this group are deer, squirrel, and rabbit representing the quadrupeds and the quail, dove, woodcock, and waterfowl representing the birds. In considering the early conditions of these species, we find that some were numerous and some were apparently not so plentiful, yet all have managed to survive. Deer and squirrel were apparently quite numerous over all of the present State of Louisiana, but in all cases the type of range has governed the size of the population. Deer apparently were most numerous in the mixed pine-hardwood forests and on the edges of prairies and meadowlands. The longleaf pine lands did not support large populations and, surprisingly, the swamp and dense river bottom areas, which now contain most of our deer, at that time were too dense and grown-up with cane and palmetto to support many. After the forests were cut, however, the brushy second growth hardwoods occurring in the bottomlands furnished an excellent, though limited, deer range. On this range, there is now found 93% of all of the deer in the State excluding the coastal marsh. (Fig. 6).

Squirrels were quite abundant in early times, but were most concentrated in the mast-producing mixed oak and hardwood areas. The pure stands of pine and the treeless prairies and marshes produced the smallest populations. Squirrels have perhaps survived best of any species. They have lost considerable range with timber operations and the advance of civilization, but where the range is available, populations are good, even at present.

The early position of the rabbit as a game animal is not too clear. In all cases, it was reported to be abundant and to range over the entire State. On the other hand, predation must have been heavy. Then, too, the clean floor of the virgin forests was probably not as good for rabbits as the highly productive areas occurring with increased farming in late years. In all probability, the peak in rabbit populations occurred sometime in the late nineteenth or early twentieth century.

Quail and dove were uniformly reported to be rare or occasional in early times. Since they are both seed and grain eaters, this is understandable. Early range conditions were not highly productive of suitable foods and the total populations were probably governed by this limiting factor. Peak population of these two species occurred much later, between 1880 and 1920, where farming was extensive but crude and when thousands of acres of timber lands were cleared increasing the range of these species.

Early writers reported woodcock and waterfowl to be quite abundant on their wintering range in Louisiana. Waterfowl, in particular, were reported to be in every available pond, lake, watercourse, and marsh. Just how much greater the populations of these species were in early times than they are now is difficult to estimate. Terrific gun pressure for food, sport, and market was placed on these species by 1850. No reliable records are available to show whether there was a marked decline in populations at this time. Later records on market kills do not show a sudden drop in waterfowl populations. The waterfowl wintering range in Louisiana has been reduced by drainage, civilization, and the encroachment of water hyacinth. This reduction of range has no doubt aided in the decline of waterfowl, but this is not believed to be the major cause of reduced waterfowl populations in the State. Factors operating outside of the State on the nesting range and gun pressure in all areas have influenced national populations and tend also to control the waterfowl wintering population in Louisiana.

AN ANALYSIS OF THE CHANGES IN LAND USE AND ITS EFFECT ON GAME

As pointed out in the preceding section, the basic causes behind the changes in game conditions from past to present are the changes that have occurred in land utilization. This concept is not original with this investigator, but rather is one of the basic concepts of game management as practiced today. It is widely supported by many authorities in the field and needs no verification at this point.

In order to see clearly the basic changes in land and its effect on game in Louisiana, it is best to divide the history of land use into four stages. These are: stage I, before the coming of white man until 1800; stage II, 1800-1880; stage III, 1880-1925; and stage IV, 1925-1950. Each stage is shorter than the preceding one since as civilization progressed, it took less time to change the land use pattern enough to have a marked effect on game. Graph 1, Fig. 8, shows the trend in game abundance during the various stages of land use from 1700 to 1950. The terms abundant, absent, rare, etc., used to designate the amount of game at various times is relative to each species individually and is based on the available historical evidence. The graph along with the following discussion of each stage is designed to show the trends in game conditions over the years and the basic causes behind these changes.

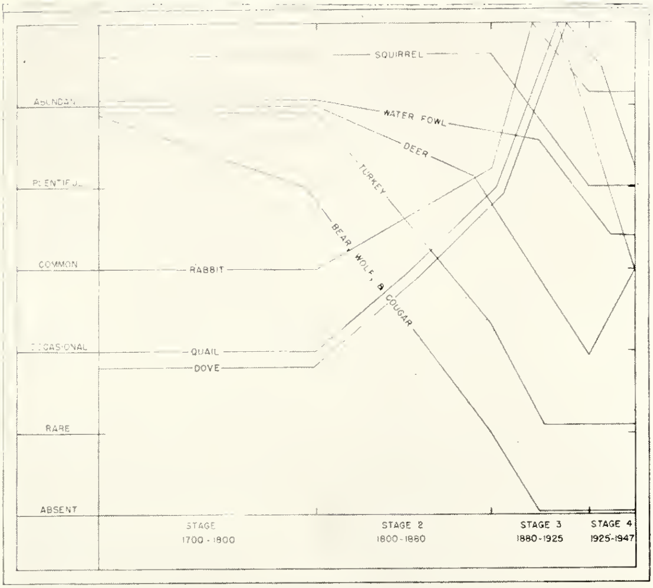
Stage I: From before the coming of the white man until 1800. During this time, the State was a virgin wilderness with only a few trading posts and settlements. The white man's presence in the area was insignificant as far as hunting pressure was concerned while hunting pressure from the Indians had been a stable condition.

Several facts about the game of this period may be unknown by the average sportsman of today. It is generally assumed that, during early times, game was abundant everywhere. This was not necessarily the case. As pointed out in the preceding section, even the abundant species were concentrated on good ranges while on poor range game was scarce. This was so true that the Indians divided the hunting grounds among the tribes and practiced game conservation on a limited scale.

Not only did the Indians practice conservation, but they were much more willing to work at their hunting than the present-day sportsman. For example, Indians from the Baton Rouge and Natchez area walked to the St. Francis River in the vicinity of the northern border of the present State of Arkansas to make their annual bear hunt and to prepare bear oil and grease. They also made frequent trips to the vicinity of Natchitoches to get salt and to have better hunting near the salt licks in that area. Perhaps, if equivalent effort and time were expended by our present day Nimrods, complaints about poor bags and small game populations would be fewer.

As described above, there is some indication that some species of game are more abundant today than during early times. This seems to be the case, particularly with farm game, especially quail and dove. In general, deer, bear, cougar, wolf, turkey, fur-bearing animals, and squirrel were relatively abundant in early times, but were concentrated on certain ranges and absent on others. Populations were known to fluctuate both locally and over large areas from time to time because of poor breeding seasons, disease, famine, drought, flood, and fire. Waterfowl and migratory shore birds had vast wintering areas in Louisiana and were abundant or scarce in the areas according to the success of the breeding season. (See Graph 1).

Stage II: From 1800-1880. This was a time of increased settling and farming of a crude nature. The timbered area remained a virtual wilderness because poor transportation methods and hand labor prevented serious lumbering. Industrialization was still far in the future. During this period, the Indians were forced from their hunting areas, and hunting pressure was not so much due to the increase in the number of white hunters as to the lack of regulations and the unwarranted slaughter of game for food and market. During this time, certain species suffered more than others because of their market value, the ease of taking them, and their slow breeding rate. In this group, bear, wolf, cougar, and, to some extent, waterfowl were hit heavily. (See Graph 1). Bear and cougar, which reproduce slowly, could not survive the hunting pressure placed upon them because of their market value and because they were considered serious predators. Turkey and waterfowl survived better during this stage because of their more rapid breeding rate and because they had always been much more numerous than the large game animals. Although deer were hunted heavily for the food market, they were abundant enough,



RELATIVE ABUNDANCE OF GAME, 1925-47

FIGURE 8. GRAPH I

bred fast enough, and had extensive enough range to absorb most of the kill without showing much decline. It was not until the range was decreased after 1880 that deer declined rapidly.

Squirrel and fur bearers seem to have remained plentiful until the end of Stage II. Quail and farm game increased during the period with the widespread development of farming of the crude type so valuable in the production of farm game. This amounted to a direct increase in the amount and quality of range used by farm game.

Stage III: 1880-1925. This represents a time in the history of Louisiana when the State may be said to have emerged from the wilderness. This emergence of the State into a settled and well-inhabited land wrought great havoc to its game resources because, for the sake of the money, millions of acres of game ranges were destroyed without thought for restoration or conservation.

During this period, practically all of the virgin forests of the State was decimated by the lumber interests, and with the forest nearly all of the large game ranges were destroyed. At this time, the remnants of the bear, wolf, and cougar populations were all but eliminated. Deer were reduced to a relatively low population by a decrease in range and heavy, unregulated hunting pressure. Turkey all but disappeared with the forest. Fur bearers and squirrel seemed the least affected by the change, but even these lost much of their upland ranges. Farm game, on the other hand, showed stability or advancement during this period. Quail in particular, reached a phenomenal population peak that can never be expected to be reproduced in the State. (See Graph 1). The direct cause for the increase in quail was the vast expanse of excellent range produced in the cut-over pinelands and the extensive but still rather crude farming in the area. Such an extremely high quail population was of short duration, however, and the peak had already passed and a decline had begun in most areas by the end of the period. This occurred, for the most part, because of the changes in the quality and quantity of quail foods available in the pinelands from the time of cutting until perennial grasses became dominant. An ecological succession of plants of this type usually takes about 7 years to complete its cycle. In general, Stage III represents the time when the general game resources of the State were lowered to such a point that it became necessary to formulate strict laws governing the harvest of game.

Stage IV: This represents the period from 1925 to the present. During this stage, the characteristic changes in land use were the expanding industrialization, the increased oil production, larger human population, specialized and more modern farming, reforestation, increased restrictions of land from public hunting, and increased hunting pressure. During the first part of this period, the depression of the early 30's slowed down most of the changes named above, but in the latter half of the period, the changes have been rapid. The effects of these changes in land use on game conditions seem to have been varied. Bear, cougar, wolf, and turkey populations have continued to be low or absent. The reason for this is that they were either totally wiped out or reduced to such a low breeding stock on a restricted range that they have been unable to increase in the face of legal or illegal hunting pressure and general disturbance on their ranges. Deer seem to have fared much better. They reached a low point in the population curve after all the timber was cut about 1920. Since that time, reforested range and better protection have resulted in an increase. Squirrel and rabbit have remained more or less stable during the period with squirrel showing possibly a small increase in the reforested and second growth forests having timber of operable size. Quail and waterfowl were the hardest hit species during the period. The quail range in the cut-over pine lands was greatly reduced by reforestation and natural second growth forests. In the remaining denuded areas, the food conditions became very poor as perennial grasses became dominant and eliminated quail food plants. More critical still are the changes in the farm land, which, after all, is the true quail range in the State. Modern mechanized farming has reduced grain crops formerly necessary to feed farm animals and tenants and, thereby, has greatly reduced the planted quail and dove foods. Mechanization on farms has also resulted in wholesale destruction of natural cover and foods under the guise of clean farming, so much that in some of the State's best agricultural areas we find the greatest decline in quail, dove, and rabbit populations. Finally, the great increase in cattle production and pasturage has been the cause of much reduction in farm game population in many areas.

Waterfowl and shore birds have also declined during this period. The local factors aiding in their reduction have been reduction of wintering grounds by drainage and land reclamation projects, increased traffic and disturbance in the remaining wintering areas, heavy hunting pressure, and the destruction of food in fresh water areas by the encroachment of the water hyacinth and alligator grass. All of these factors along with the destruction of breeding areas and changes in the breeding grounds in North America have aided in the decline of the waterfowl and shore bird populations wintering in Louisiana.

A STATISTICAL ANALYSIS OF PAST AND PRESENT GAME CONDITIONS

As pointed out earlier in this discussion, most past and even present observations on game populations are highly relative and such terms as abundant, occasional, rare, etc., vary with the individual observer and with the period in which observations were made. In order to put the changes in game conditions on a sounder sta-

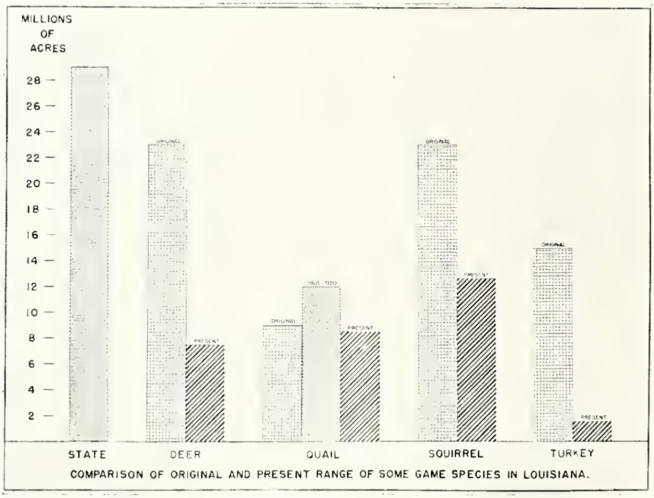
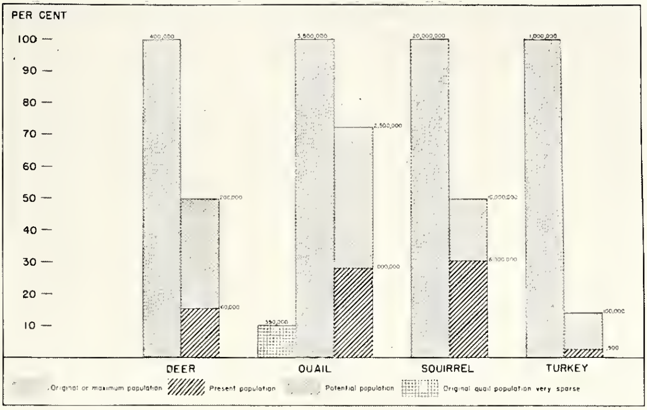


FIGURE 9. GRAPH II

tistical basis, the following approach to the problem is offered. In this case, all changes have been based on the known changes in range acreages and the estimated carrying capacity of the range for each type. Admittedly, arguments may be presented as to the acceptable average carrying capacities, but since the approximate present-day carrying capacities are known, productivity in past years can be judged well enough to show the percentage change that has occurred for a given species. Only those species have been considered that are native to the State and on which there is reasonably complete data.

Graph II, Fig. 9, is a summation of the actual changes in range for the species under consideration. In this graph, the column at the extreme left represents the 29,000,000 acres that make up the State of Louisiana. The left-hand column for each species of game represents the estimated maximum range of that particular species in the original virgin wilderness while the column on the right represents the present range. The difference in height of the two columns for each species indicates the loss or gain in range. For example, in early times, approximately 23,000,000 of the 29,000,000 acres of the State was good deer range. At present, because much of the



COMPARISON OF ORIGINAL, PRESENT, AND POTENTIAL POPULATION OF SOME GAME SPECIES IN LOUISIANA, ASSUMING THE ORIGINAL POPULATION TO HAVE BEEN 100 PER CENT.

FIGURE 10. GRAPH III

forests have been cut-over, only 7,500,000 acres remain. In the case of quail, three columns are shown because the available range between 1900 and 1920, shortly after the timber was clear cut, was greater than at any other time. The loss since then has been caused by reforestation. The original virgin quail range, though slightly greater than the present, was made up of prairie land, natural meadows, burned areas, and the virgin longleaf pine areas, all of which were very poor quail producers in comparison to farm lands and the freshly cut pine lands of more recent years. Squirrel and turkey both suffered a loss of range with the cutting of the forests, but turkey were much the harder hit since they require more mature and virgin stands of timber. There is very little such timber left in the State.

Graph III, Fig. 10, presents a summation of the statistical facts about game populations based on the carrying capacity of the range and the amount of range. To allow for all species to be charted together with figures which are only approximate, the entire group of data has been presented from the percentage standpoint. In other words, Graph III shows the percent of each type of game in the past and at present, the future potential based on the amount of original range, the present range, and the carrying capacity for each species. For example, in the case of deer, the original wilderness range of 23,000,000 acres is thought to have produced a maximum average of 1 deer to 50 or 60 acres for an estimated total population of approximately 400,000 for the entire State. This original population is set at 100% for the State (left column) because it is estimated as the maximum that could ever be produced under any condition. At present, the total deer population for the State is 60,000 or about 15% of the original population (lower part of right column). The present available deer range in the State is 7,500,000 acres. (See Graph II). This should produce, under good management, at least 150,000 to 200,000 deer. This potential population is represented in the extension of the right hand column.

The question presenting itself at this point is how approximately 30% of the original range that is present today can produce an estimated potential maximum population equal to nearly 50% of the original population. The answer to this is that the remaining deer range in the State is a better type of range than the original with a carrying capacity higher than the estimated original average. The reason for this is that present-day second-growth forests have a much higher food production in the brushy under-story than did the virgin forest. The result is perhaps a conservative estimated carrying capacity at between 30 to 40 acres to the deer.

In the case of quail, the maximum population of 3,500,000 was not reached until 1910-1925, therefore, the center column represents 100% production. The left column indicates the original virgin population and the right column illustrates the present and potential quail population of the State under good management. Squirrel and turkey should be read the same as deer with the left column indicating 100% production and the right the present and potential population.

A more critical examination of Graphs II and III indicate several inescapable facts. In the first place, there has been an actual loss of range by each species of game. This loss reaches a maximum of 90% in the case of the turkey and a minimum of a 30% for quail. The other species fall between these extremes. The second obvious fact is that at present the remaining range is not producing in a manner equivalent to its original maximum production. For example, although quail retain 70% of the maximum range that existed between 1900-1920, the present population is only 30% of the maximum population that was reached in 1900-1920. Deer with 30% remaining range have a present population that is only 15% of the original. Squirrel with 56% of the original range have a population of only 35% of the original, and turkey with 10% remaining range have a population that is only 0.2% of the original.

The primary causes that prevent the existing ranges from producing at a maximum rate vary with the species. In the case of deer, illegal hunting and lack of protection from dogs and dog hunting have prevented maximum production. Quail ranges fail to produce at the expected rate because a marked change in carrying capacity has occurred as a result of the effect of land use practices on food and cover. Squirrel and turkey have been prevented from increasing by incorrectly timed or too long seasons and by illegal kills.

All of these causes of failure to produce will be expanded and discussed in full in the detailed description of the inventory of each species.

THE ECOLOGICAL DIVISIONS OF LOUISIANA

In order to inventory and describe accurately the present-day game conditions in Louisiana, certain basic biological tenets must be adhered to in both the analysis and presentation of the data. First, it must be recognized that all animals, whether game or not, are confined more or less to certain ecological niches in the natural scheme of things. In other words, local environment largely controls the distribution and production of the individual species. It is also true that the environment, even in the natural virgin condition, was basically controlled by soil, topography, and climate. For example, the bison, a plains animal in early times, was confined to those areas that did not grow dense forests. Tree squirrels, on the other hand, are naturally confined to mast producing hardwood forest and are not able to survive on the plains. Waterfowl, as another example, demand certain aquatic habitats to survive.

There are certain natural ecological divisions that form different types of game range such as forests, prairies, marshes, and swamps, but man in recent history has superimposed the effects of his activities such as farming, lumbering, industry, and increased human population on these natural ranges. Where once was a dense forest suitable for deer and turkey, we may find now vast farmed areas suitable only for farm game such as quail and rabbit. Furthermore, such game populations are largely controlled by the methods used in various types of farming. Other examples of man's effect on game ranges include the draining of swamps and marshes, the cutting and burning of the longleaf pine areas, and the converting of once virgin forest by cutting to second-growth forest areas of a different type and density.

It is evident from the examples cited above that man-made boundaries, political or otherwise, have no control over the distribution of game nor can such boundaries as parish, wards, or state lines be readily incorporated in a game inventory or management plan for a large area. Since this is the case, for the purpose of this study, Louisiana has been divided into six natural areas, based primarily on their soils, topography, and natural ecological differences, but secondarily characterized by differences brought about as a result of man's use of his land. (Fig. 11).

Table 3 lists the natural ecological divisions of Louisiana with a summary of statistics and remarks about each division. Important facts to take note of in the Table are these: 1. size of

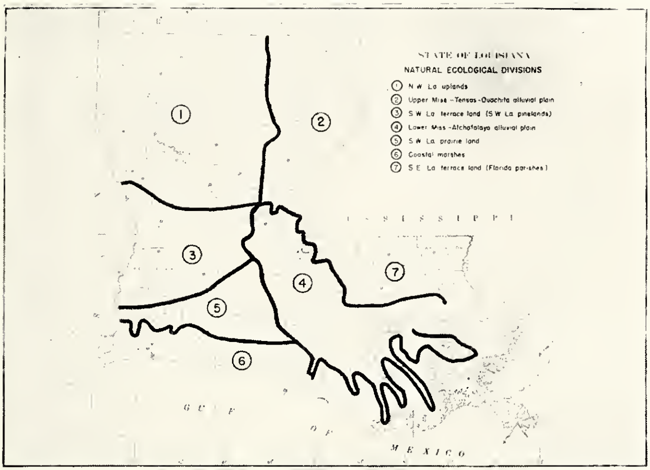

STATE OF LOUISIANA
NATURAL ECOLOGICAL DIVISIONS
① N W La uplands
② Upper Miss -Tensas-Ouachita alluvial plain
③ S W La terrace land (S W La pinelands)
④ Lower Miss -Atchafalaya alluvial plain
⑤ S W La prairie land
⑥ Coastal marshes
⑦ S E La terrace land (Florida parishes)
①
②
③
④
⑤
⑥
⑦
MISSISSIPPI
GULF OF MEXICO

FIGURE 11.

each area, 2. amount and kind of forest and farm lands, 3. the percentage of farm acreage as compared to forest acreages, 4. and the fact that some parishes may be included in several divisions. These basic facts will, to a great extent, control the kind and amount of game for each division. For example, heavily forested areas may be made to produce deer, turkey, and squirrel, but only limited amounts of quail, dove, or waterfowl. Prairie lands cannot be expected to produce deer or turkey, nor will they produce farm game where cover is lacking. Following are brief descriptions of the ecological divisions with emphasis on those characteristics which have the greatest effect on game distribution and populations.

LOWER MISSISSIPPI-ATCHAFALAYA BOTTOMLANDS

This division with an area of over 4,000,000 acres includes all or parts of 17 parishes that lie along the lower Mississippi-Atchafalaya systems. Some of these parishes also border much of the coastal marsh. (Tables 3 & 4, Fig. 11). Forests make up 64 percent of the area. The major forest types are basically cypress-tupelo and red gum and mixed hardwoods along with associated types, such as overcup oak, bitter pecan, and hackberry-

TABLE 3

THE BROAD ECOLOGICAL DIVISIONS OF LOUISIANA AS THEY RELATE TO GAME RANGES

Natural Divisions	Approximate total area	Principal forest types	Forest type acreages	Total forest acreage	Percent of area in forest	Principal farm crops of area	Total farm acreage	Percent of area in farms	No. of parishes involved	Remarks
Lower Mississippi-Atchafalaya Alluvial Plain	4,024,782	Redgum-mixed bottomland Hardwoods Cypress-tupelo swamps	1,486,469 1,092,100	2,578,569	64.3	Sugar cane, rice, cotton, pasture	1,321,306	33.3	17	This is an area of plantation-type highly mechanized farms; 3% of the total area is unclassified. Large cypress-tupelo swamps are characteristic of the area.
Upper Mississippi, Tensas, Ouachita, and Red River Alluvial Plain	4,548,069*	Redgum-mixed hardwoods; oaks mixed hardwoods; overcup oak-bitter pecan	3,055,975	3,055,975	67.2	cotton, grains pasture	1,412,444	31.0	12 & Red River Valley	This area is of two types, large plantation, mechanized farms on Mississippi River, and smaller, more diversified, less mechanized farms on Macon Ridge.
Northwest Louisiana Uplands	7,767,451*	Pure pine Pine hardwood Mixed bottom-land hardwood	2,320,113 1,528,499 1,484,138	5,332,750	68.7	Diversified, hill type farms, cotton, grain, pasture	1,884,890	24.2	18	This area of two types— 1. Central section—heavily wooded with few farms. 2. Northern section — more heavily farmed.
Southeast Louisiana Terrace Lands (Florida Parishes)	2,859,246	Pure pine-long leaf, slash, loblolly Loblolly pine-hardwood. (Red oaks, magnolia bay, beech) Mixed oaks and hardwoods	1,061,846 337,088 562,983	1,961,917	68.6	Truck crops, dairy farming, pasture & diversified general farms	713,455	24.9	8	This area similar to S. W. Terrace Lands, but basically better soils make for better farming and a better second growth forest. Much of the pure pine land in this area is now barren grassland.

Southwest Louisiana Terrace Lands (Southwest Pine area)	3,650,703	Pure pine & pine barrens	2,123,924	3,089,561	84.6	Diversified, hill farms, cotton, corn, truck, pasture	406,446	11.3	7	This area is characterized by vast areas of cut-over pine barrens, and a minimum amount of farming on the sandy sterile soils.
		Pine-hardwood (loblolly oaks)	475,520							
		Oaks & mixed hards	490,117							
Southwest Louisiana Prairie Lands	2,350,040	Pine-cut over	63,173	491,436	20.9	Rice farming center of La.; pasture, some cotton & potatoes	1,396,286	59.4	7	This area characterized by its lack of forest areas and the vast expanses of poorly drained grasslands suitable only for rice farming and pasture.
		Pine-hardwoods	70,267							
		Mixed bottomland hardwoods	357,996							
Coastal Marshes	4,514,299	Bottomland hardwoods-cypress-tupelo	77,769	77,769	1.8	Rice farming, pasture, citrus crops, general farming	174,320	40	11	This area characterized by its 3,929,298 acres of tidal marshes suitable only for waterfowl, fur animals and minerals.
TOTAL	30,004,590[1]		16,777,977[1]	16,777,977[1]	56.2[1]		7,282,147[1-2]	24.3[1]		19.5% of the total state area in marshlands, unclassified lands and water areas.

* Red River Valley consisting of some 700,000 acres added to both of these sections.

[1] Totals only approximate because acreages were estimated in cases where a parish was divided between two or more sections.

[2] Only open and cultivated farmland acreage. Farm woodlots included under forest.

TABLE 4

LOWER MISSISSIPPI-ATCHAFALAYA ALLUVIAL PLAIN

Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest Breakdown
Ascension	192,000	71,304	120,384	4,815 b 115,569 c
Assumption	228,480	66,329	144,628	 c
Avoyelles	528,640	157,633	310,840	3,108 a 6.217 b 301,515 c
Iberia*	252,391	129,295	123,096	 c
Iberville	391,040	84,402	293.863	 c
Lafourche*	318,708	138,964	179,744	 c
Livingston**	144,982	....	144,982	 c
Pointe Coupee	360,960	142,061	242,306	 c
St. James	159,360	52,916	94,969	 c
St. John	144,000	29,130	102,504	 c
St. Landry***	480,000	217,938	284,565	 c
St. Martin	472,320	101,979	330,233	 c
St. Mary*	163,809	85,909	77,900	 c
Tangipahoa**	59,452	....	59.452	 c
W. Baton Rouge	128,640	43,446	69,104	 c
Total	4,024,782	1,321,306	2,578,569	

* Includes farmlands and forest only. Remainder of area in marsh shown in Table 22.

** Only hardwood area of parish in this section, remainder of area in Table 8.

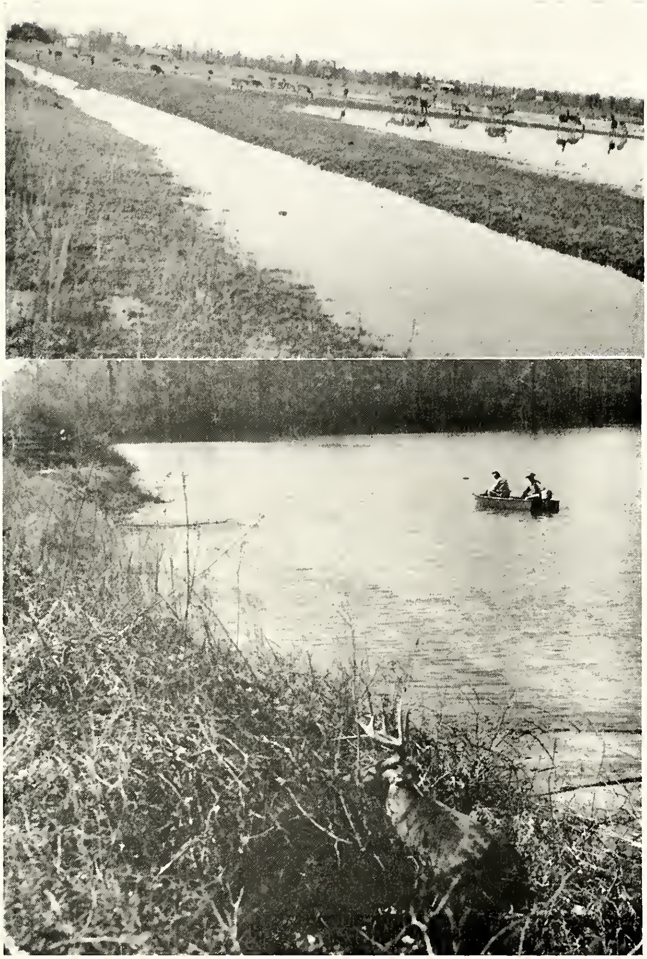
*** Prairie section of this parish in Table 19.

a Pure Pine

b Pine-hardwoods

c Bottomland hardwoods

elm-ash. Cypress (*Taxodium distichum*) and tupelo gum (*Nyssa aquatica*) swamps make up 40 percent of the total forest areas. These vast swamps are either permanently or periodically inundated. They consist primarily of scrub cypress left after cutting and partially cut-over stands of tupelo gum. (Plates 1, & 2). For the most part, such swamps are rather densely covered with scrub second growth and associated types such as pumpkin-ash (*Fraxinus tomentosa*), Drummond's red maple (*Acre drummondii*), and button bush (*Cephalanthus occidentalis*). The small shrubs in the under-story include Virginia willow (*Itea virginica*), palmetto (*Sabal minor*), switch cane (*Arundinaria tecta*), and blackberry (*Rubus spp.*) on the ridges, and cattail (*Typha spp.*), water hyacinth (*Eichornia crassipes*) and alligator weed (*Alternanthera philoxeroides*) in the wetter areas. It is characteristic of the swamps that natural levees and higher ridges occur throughout



PLATES 3 AND 4.

Flooding in bottomland and swamp areas at times is detrimental to deer. Note deer forced into open farmland by flood waters. Here they are more accessible to illegal hunting.

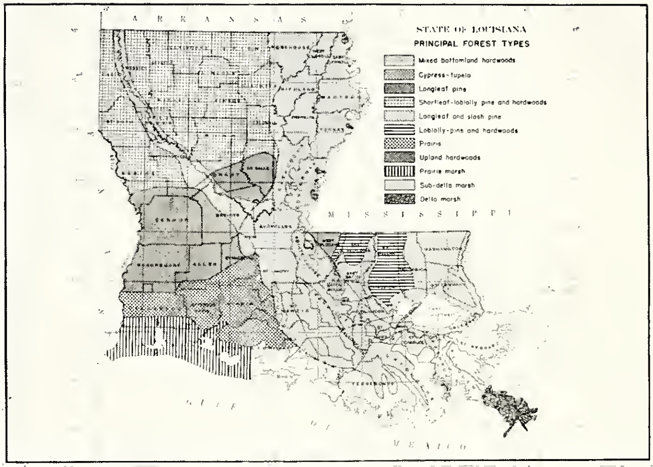


FIGURE 12.

their edges which support oaks, red gum, maple, ash, bitter pecan, and other higher land types. The more prominent cypress-tupelo areas are located along the lower reaches of Bayou Lafourche, the Atchafalaya and Mississippi Rivers. (Fig. 12).

The remaining 60 percent of the total forest area of the lower Mississippi-Atchafalaya division consists of red gum and mixed hardwoods forming about 21 percent of the stand; overcup-oak-bitter pecan about 12 percent of the stand; hackberry-elm-ash, 14 percent; and cottonwood-willow makes up the remaining 13 percent. The red gum-oak association is found primarily on the higher, better drained areas, although in exceptional cases, large portions of this type may be periodically inundated. The overcup-oak-bitter pecan type is primarily confined to areas subject to annual or frequent flooding and, for the most part, these areas are in the northern section of the division in Avoyelles and St. Landry parishes. (Compare maps—Figs. 5 & 12). The hackberry-elm-ash type is transitional from swamp to higher types like red gum and oaks and is found scattered where slight elevations occur. Cottonwood-willow is primarily found along stream courses.

The primary under-story associates throughout the division are switch cane (*Arundinaria tecta*), palmetto (*Sabal minor*),

TABLE 5

SUMMARY OF FOREST CONDITIONS

LOWER MISSISSIPPI-ATCHAFALAYA BOTTOM LANDS

	Types Involved[1]	Type numbers[2]	Percent of each type	Occurrence	Indicator species
1. Cypress-tupelo swamps make up 40% of forest in area.	Cypress-tupelo gum	94 95	40.0	Occurs on very wet areas, permanently or frequently inundated—standing water over most of area.	*Taxodium distichum, Nyssa aquatica, Planera aquatica, Salix nigra, Fraxinus tomentosa, F. pennsylvanica, Celtis laevigata, Quercus lyrata.*
2. Mixed hardwoods make up 60% of forest in area.	Red gum-mixed oaks hardwoods	81 82 83 85 88	21.0	Occupies highest part of first bottom. These are better drained sites in area but still low enough to be flooded occasionally.	*Liquidambar styraciflua, Quercus nuttallii, Q. nigra, Q. phellos, Q. obtusa, Q. lyrata, Ulmus americana, Fraxinus pennsylvanica.*
	Overcup oak bitter pecan	89	12.0	Occupies lowest, poorest drained areas excepting swamp proper; subject to periodic flooding.	*Quercus lyrata, Carya aquatica, Quercus phellos, Fraxinus pennsylvanica, Acer drummondii.*
	Hackberry-elm-ash	85 86	14.0	Occupies sites just higher than overcup oak. Occurs as second growth after cutting redgum. Found on poorly drained soils.	*Celtis laevigata, Ulmus americana, U. crassifolia U. alata, Fraxinus pennsylvanica.*
	Cottonwood Willow	61 88	13.0	Primarily along streams and on sandy batture lands.	*Populus deltoides, Salix nigra, Salix longifolia, Gleditsia aquatica, Taxodium distichum.*

[1] Based on standard cover types of Eastern United States.

[2] Standard cover type numbers of types of Eastern United States.

TABLE 6

MORE COMMON FOREST PLANT SPECIES OF THE LOWER MISSISSIPPI-ATCHAFALAYA BOTTOM LANDS

DOMINANT

CYPRESS *(Taxodium distichum)*
COTTONWOOD *(Populus deltoides)*
SWAMP COTTONWOOD *(P. heterophylla)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(S. interior)*
PECAN *(Carya illinoensis)*
BITTER PECAN *(C. aquatica)*
SWAMP HICKORY *(C. leiodermis)*
PIGNUT HICKORY *(C. glabra)*
OVERCUP OAK *(Quercus lyrata)*
COW OAK *(Q. prinus)*
LIVE OAK *(Q. virginiana)*
NUTTALL OAK *(Q. nuttallii)*
SHUMARD OAK *(Q. shumardii)*
SWAMP RED OAK *(Q. pagoda)*
WATER OAK *(Q. nigra)*
OBTUSA OAK *(Q. obtusa)*
WILLOW OAK *(Q. phellos)*
AMERICAN ELM *(Ulmus Americana)*
WINGED ELM *(Ulmus alata)*
CHINESE ELM *(Ulmus parvifolia)*
HACKBERRY *(Celtis laevigata)*
WATERELM *(Planera aquatica)*
MULBERRY *(Morus rubra)*
RED BAY *(Persea barbonia)*
SWAMP REDBAY *(Persea pabustris)*
REDGUM *(Liquidambar styraciflua)*
SYCAMORE *(Platanus occidentalis)*
DRUMMOND RED MAPLE *(Acer drummondii)*
TUPELOGUM *(Nyssa aquatica)*
GREEN ASH *(Fraxinus pennsylvanica)*
PUMPKIN ASH *(F. tomentosa)*
WATER ASH *(F. caroliniana)*

SUB-DOMINANT

PALMETTO *(Sabal minor)*
WAXMYRTLE *(Myrica cerifera)*
PAWPAW *(Asimina triloba)*
SASSAFRAS *(Sassafras albidum)*
VIRGINIA WILLOW *(Itea virginica)*
HAW TREE *(Crataegus spp.)*
SWEET ACACIA *(Acacia farnesiana)*
HONEY LOCUST *(Gleditsia triacanthos)*
WATER LOCUST *(Gleditsia aquatica)*
TOOTH-ACHE TREE *(Xanthoxylum clava-herculis)*
CANDLEBERRY *(Sebastiana ligustrina)*
DECIDUOUS HOLLY *(Ilex decidua)*
YAUPON *(Ilex vomitoria)*
AMERICAN HOLLY *(Ilex opaca)*
WHITE ALDER *(Clethra tomentosa)*
SNOWBELL *(Styrax spp.)*
SWAMP PRIVET *(Forestiera acuminata)*
FRENCH-MULBERRY *(Callicarpa americana)*
BUTTONBUSH *(Cephalanthus occidentalis)*

briars (*Rubus spp.*), hardwood sprouts, and various grasses and legumes in the more open areas. The density of these types is largely controlled by open range grazing and where it is heavy, a dense under-story may not be evident. See Table 5 for a summation of the forest types in the area and Table 6 for a list of the species involved.

Farm lands make up 33 percent of the total area of the lower Mississippi-Atchafalaya Bottomland Division excluding farm lots which were included in the forest sections. This highly fertile farm region includes over 1,300,000 acres, that for the most part, are contained in large plantation type farms situated on the higher better drained natural levees of streams. The farm plan is usually to cultivate or clear all land between the crests of natural levees along streams as far back as the swamp. This results in a long strip of farm lands along the major streams with swamps or less well-drained wooded areas to the rear. The majority of these

PLATE 5

This air photograph of the clean, hedgerowless plantation indicate clearly what has happened to the farm game in these areas. Food and cover are practically nonexistent and game cannot survive in the area.

large farms produce sugar cane, rice, or cotton, but many are now being used for pasture and cattle production. For the most part, they are highly mechanized and clean, leaving little natural food or cover for farm game. (Plates 5, 6, 7). This point will be considered in some detail later in the report.

The major characteristics of this division as they affect game types and populations are listed as follows:

1. Much of the area is forested and is either permanently or periodically flooded.

2. Even the higher land type forests are subject to flooding under extreme conditions. (Plate 4).

3. The forests, as a whole, offer good food and extensive range suitable for the many species of forest game.

4. Farm areas are relatively extensive, but the manner of farming leaves much to be desired in the way of farm game habitat.

5. The present crop plan and the extremely clean farming practices leave little in the way of natural or planted food or cover on the large plantations. (Plates 5, 6, 7).

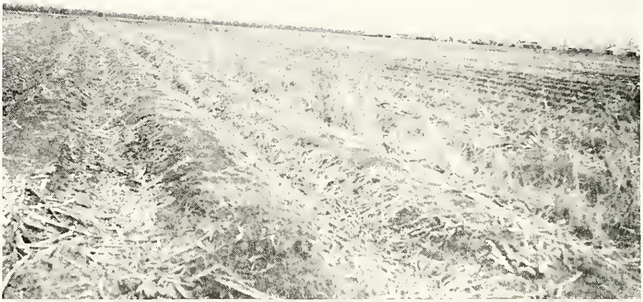


PLATE 6

These photographs taken during the mid-winter illustrate the effect of modern farming methods on game. Such clean cotton and sugar cane fields are supporting no game at the height of the hunting season. This condition, occurring over months which are critical in the life cycle of farm game, has eliminated many such areas as game range.

PLATE 7

The great increase in heavily grazed pasture lands such as these has eliminated hundreds of thousands of acres of quail and rabbit range. Such clean areas are virtually devoid of all game requiring cover and plant foods.

TABLE 7

UPPER MISSISSIPPI-TENSAS-RED RIVER BOTTOMLANDS
Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest Breakdown
Caldwell (E. 1/3)	142,888	21,000	121,888	c
Catahoula xx	201,925	75,535	103,660	c
Concordia	453,760	79,056	374,258	c
East Carroll	276,480	107,805	135,000	c
Franklin	414,720	203,982	226,100	c
Madison	423,680	139,274	313,207	c
Morehouse	514,560	126,835	331,940	39,833 a 36,513 b 255,594 c
Ouachita x	161,280	23,040	139,241	
Rapides xxx	226,296	102,491	123,805	
Richland	368,640	171,603	189,225	
Tensas	398,720	112,746	271,419	
West Carroll	227,840	111,797	126,232	
	3,810,789	1,275,164	2,455,975	
Red River Valley*	737,280	137,280	600,000	c
	4,548,069	1,412,444	3,055,975	

x East 1/3 only. Remainder of parish in Table 10.
xx Pine hill portion in Table 10.
xxx Divided three ways. See Tables 4 and 10.

a Pure pine.
b Pine hardwood.
c Bottomland hardwood.

* Red River Valley made up of parts of several parishes.
This area also added in Table 10.

THE UPPER MISSISSIPPI, TENSAS, OUACHITA, & RED RIVER BOTTOMLANDS

This division includes all or parts of 17 parishes that lie in the Upper Mississippi River Bottomland and in the bottomlands of the Red, Tensas, and Ouachita Rivers. (Fig. 11). It contains some 4,500,000 acres (Tables 3 & 7) although it is made up of recently deposited river alluvium and supports bottomland hardwoods, its better drainage, different soil types, higher land type hardwoods, and difference in crops warrants placing it in a separate division from the Lower Mississippi. The entire area may be divided into three sub-sections; their topography and amounts and distribution of farm and forest lands make them differ in their suitability for game production. These sub-sections are the Upper Mississippi alluvial lands, the Macon Ridge Area, and the Red River Valley. The following description will first encompass the entire division and then the characteristics of each sub-section will be discussed.

The forest lands of the Upper Mississippi-Tensas-Ouachita-Red River Bottomlands consist of over 3,000,000 acres of bottomland hardwoods. This is 67.7 percent of the total area and represents some of the finest forest game range in the State. In general, the forest types range from large blocks of overcup oak and bitter pecan in the wetter areas, subject to periodic inundation, through red gum and mixed hardwoods on the next higher terrace, to oaks and mixed hardwoods on the highest areas. The various types found in the area are listed in the forest type Table. (Table 8).

The percentages of each forest type are approximately as follows: red gum-water oak, mixed hardwood, 25 percent; hackberry-elm-ash, 15 percent; overcup oak-bitter pecan, 31 percent, cypress-tupelo, cottonwood-willow and other types make up the remaining 29 percent.

The sub-dominant trees and shrubs of the understory consist of red maple (*Acer drummondii*), haw (*Crataegus spp.*), dogwood (*Cornus drummondii*), holly (*Ilex spp.*), buttonbush (*Cephalanthus occidentalis*), red mulberry (*Morus rubra*), water elm (*Planera aquatica*), French mulberry (*Callicarpa americana*), palmetto (*Sabal spp.*), and switch cane (*Arundinaria tecta*). (Table 9) The under-story is also well supplied with various grasses and vines.

The entire forested area of the Upper Mississippi Alluvial region is fairly high and the large cypress-tupelo areas of the southern section are absent. Much of the area, however, is subject to periodic inundation and small cypress-tupelo breaks of the contain water most of the time. (Compare maps, Figs. 5 & 12).

The farm lands of the entire area are confined to the higher better drained fertile lands of the river valleys. These farm lands make up 31 percent of the area, but the amount of farm land varies considerably in the three sub-sections; this is one of the main reasons for separating them. Primarily, the area is in cotton, grains, legumes, cattle production, pasture, and general farming. Farming in these three sub-sections is discussed separately below. (See Farm map, Fig. 13).

UPPER MISSISSIPPI VALLEY:

In this area, the manner of farming is quite similar to that of the Lower Mississippi Valley. On the large plantation types,

TABLE 8

SUMMARY OF FOREST TYPES
UPPER MISSISSIPPI ALLUVIAL PLAIN

	Types involved*	Type numbers*	Percent of each type	Occurrence	Indicator species
MIXED BOTTOMLAND HARDWOODS (Cypress–tupelo and pine–hardwoods in negligible amounts)	Red gum–mixed hardwoods	81 82 83 84 85	25.0	On better drained sites of first bottom and loamy flats of second bottom. Occasionally subject to flooding.	*Liquidambar styraciflua, Quercus nuttallii, Q. nigra, Q. phellos, Q. obtusa, Q. lyrata, Ulmus americana, Fraxinus pennsylvanica.*
	Overcup oak–bitter pecan	89	30.0	Occupies poorly drained flats in first bottom. Subject to periodic inundation.	*Quercus lyrata, Carya aquatica, Quercus phellos, Fraxinus pennsylvanica, Acer drummondii.*
	Hackberry–elm–ash	85 86	15.0	Occurs in cut-over redgum – oak areas. Also on less well-drained flats or in transitional areas from low to high areas.	*Celtis laevigata, Ulmus americana, U. crassifolia, U. alata, Fraxinus pennsylvanica.*
	Cottonwood–willow	61 88	9.0	Along streams and sandbanks or batture lands.	*Populus deltoides, Salix nigra, Salix longifolia, Gleditsia aquatica, Taxodium distichum.*
	Redgum–mixed oak–mixed hardwood	79 80 81	9.0	Occupies the highest crest of ridges and better drained sites–characteristic of bluff and terrace lands.	*Liquidambar styraciflua, Quercus pagoda, Q. prinus, Q. nigra, Q. stellata, Carya spp., Nyssa sylvatica, Gleditsia triacanthos, Q. alba.*
	Water oak		7.0	More common on the better drained flats.	*Quercus nigra, Q. obtusa, Q. phellos, Q. pagoda, Liquidambar styraciflua.*
	Cypress–tupelo	94 95	3.5	Permanently wet areas.	*Taxodium distichum, Nyssa aquatica, Acer drummondii, Quercus lyrata.*
	Pine-hardwoods	69 70	1.1	Tops of ridges and on specific soil types.	*Pinus taeda, Quercus alba, Q. stellata, Nyssa sylvatica, Q. falcata, Carya spp.*

* Standard type numbers of the cover types of the eastern United States.

TABLE 9

MORE COMMON FOREST PLANT SPECIES OF THE UPPER MISSISSIPPI ALLUVIAL PLAIN

DOMINANT

BALD CYPRESS *(Taxodium distichum)*
COTTONWOOD *(Populus deltoides)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(Salix interior)*
PECAN *(Carya illinoensis)*
BITTER PECAN *(Carya aquatica)*
BITTERNUT HICKORY *(Carya cordiformis)*
PIGNUT HICKORY *(Carya glabra)*
SHAGBARK HICKORY *(Carya ovata)*
WHITE HICKORY *(Carya tomentosa)*
OVERCUP OAK *(Quercus lyrata)*
COW OAK *(Quercus prinus)*
NUTTALL OAK *(Quercus nuttallii)*
SHUMARD RED OAK *(Quercus shumardii)*
SWAMP RED OAK *(Quercus pagoda)*
SOUTHERN RED OAK *(Quercus falcata)*
OBTUSA OAK *(Quercus obtusa)*
WILLOW OAK *(Quercus phellos)*
AMERICAN ELM *(Ulmus americanus)*
WINGED ELM *(Ulmus alata)*
CEDAR ELM *(Ulmus crassifolia)*
HACKBERRY *(Celtis laevigata)*
WATERELM *(Planera aquatica)*
RED MULBERRY *(Morus rubra)*
REDGUM *(Liquidambar styraciflua)*
SYCAMORE *(Platanus occidentalis)*
RED MAPLE *(Acer rubrum)*
TUPELOGUM *(Nyssa aquatica)*
WHITE ASH *(Fraxinus americana)*
WATER ASH *(Fraxinus caroliniana)*

SUB-DOMINANT

PALMETTO *(Sabal minor)*
WAXMYRTLE *(Myrica cerifera)*
PAWPAW *(Asimina triloba)*
SASSAFRAS *(Sassafras albidum)*
VIRGINIAWILLOW *(Itea virginica)*
HAWTHORN *(Crataegus spp.)*
HONEYLOCUST *(Gleditsia triacanthos)*
WATERLOCUST *(Gleditsia aquatica)*
PRICKLY-ASH *(Zanthoxylum clava-herculis)*
SUMAC & POISON IVY *(Rhus spp.)*
DECIDUOUS HOLLY *(Ilex decidua)*
YAUPON *(Ilex vomitoria)*
AMERICAN HOLLY *(Ilex opaca)*
INDIANCHERRY *(Rhamnus caroliniana)*
SNOWBELL *(Styrax spp.)*
SWAMP PRIVET *(Forestiera acuminata)*
BUTTON BUSH *(Cephalanthus occidentalis)*

highly mechanized farms are situated between the crests of natural levees and the swamps to the rear. The principal crops are cotton and pasture; exceptionally clean farming is practiced. Little natural or planted food or cover is available to farm game during many months of the year in this area. (Plates 5 and 6). This sub-section includes the parishes of Catahoula, Concordia, Tensas, Madison, and East Carroll. In this area, about 28 per cent of the land area is farmed.

The Macon Ridge Area:

This is an extensively farmed area on the fertile bluff and high terrace lands of the Arkansas Alluvial Cone Unit. It includes all or parts of the parishes of Catahoula, Caldwell, Richland, Franklin, Ouachita, Morehouse, and West Carroll. (See map, Fig. 1).

In this area, nearly 50 per cent of the entire sub-section is in farms, but because of the nature of the topography and the occurance of old channel scars, the farms must, of necessity, be relatively

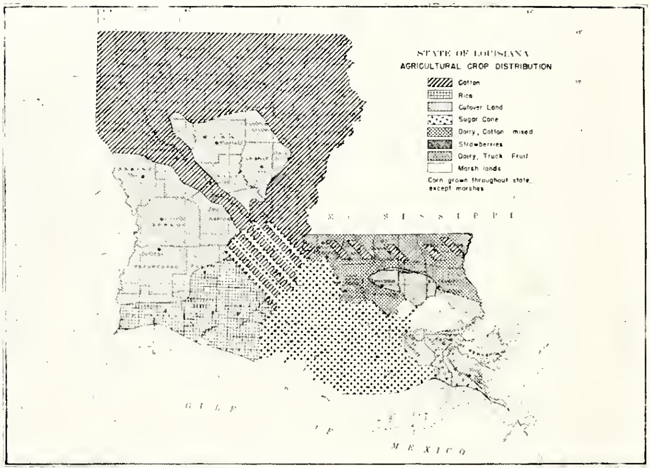


FIGURE 13

small, or else they are cut-over by many tortuous, wooded drainage gulleys. This precludes excessive destruction of natural game foods and cover because clean farm practices and extreme mechanization cannot be readily applied to such areas. The result is much more "edge" consisting of both food and cover and therefore, greater production of farm game per unit area (Plate 8). The fact that the entire area is so extensively farmed, however, leaves something to be desired in the way of deer and large forest game range in this sub-section.

THE RED RIVER VALLEY:

The Red River Valley offers essentially the same conditions to game as does the Upper Mississippi Valley sub-section. It is separated because of its isolated location in relation to the remainder of the unit. It is placed in this general division only for the purpose of description and comparison. In considering the game possibilities of the area, it is necessary, because of its relatively small area and its position, to place this region in the Northwest Louisiana Uplands.

The forest lands of this area are essentially as described above

PLATE 8

Typical bottomland farm quail range. Uncleaned fields and weedy edges furnish good food and cover. Long narrow fields between wooded gullies (top) increase the amount of "edge".

for the section as a whole and the nature of farming is almost identical with that of the Upper Mississippi Valley. Large cotton and cattle plantations are the rule; mechanization is widespread and extremely clean farming is the result. The total area of farm lands in this sub-section is not more than 20 percent.

SUMMARY

The major characteristics of the Upper Mississippi Alluvial divisions as they will affect game types and population may be listed as follows:

1. Much of the area is rather heavily forested with mixed bottomland hardwoods in large blocks. It furnishes some of the best forest game range in the State.
2. Although higher than the lower Mississippi flood plain to the south, much of this area is still subject to flooding from back waters of the Mississippi and Red Rivers. (Plate 4).
3. Farm game range throughout much of the area is the characteristic clean-farmed plantation type with food and cover rather limited. This, of course, is not conducive to high farm game populations.
4. The Macon Ridge Area is an exception; here game food and cover on farmlands is plentiful primarily because of topographical conditions.

NORTHWEST LOUISIANA UPLANDS

This division is the largest natural ecological division in the State. It includes an area of over 7,700,000 acres and makes up all or part of 18 parishes. (Table 3, 10, & Fig. 12). This hilly land is geologically the oldest section of the State, and topographically, it is the highest and most eroded. (See section on geology). Qualitatively, the section is uniform in character over the entire area, but the south central part has so much less farm land than the remainder of the area that it must be classed as a sub-section for the purpose of discussing farm game. (See quail map, Fig. 14).

The forests of this division are extensive, consisting of more than 5,300,000 acres or some 68 percent of the total area. This vast forest is basically divided into pure pine (43 percent), pine-hardwood (28 percent), and mixed bottomland hardwood (27.8 percent) by the United States Forest Service and the Louisiana Forestry

PLATE 9

(Top). Mixed bottomland hardwoods forest. Excellent deer and squirrel range. (Bottom). Bottomland hardwoods in Atchafalaya spillway. This area suitable for deer development

PLATE 10

Large acreages of good deer and squirrel range are being cleared for cultivation and pasture in the Mississippi bottomlands. This is a direct loss in range acreage not easily compensated.

PLATE 11

Semi-open pine-scrub oak forest of the hilly Northwest Louisiana Uplands. The carrying capacity for all game species is low on such hill types.

Commission. (Table 11). This system of typing, however, is based on the virgin production of the area to a great extent, and in all cases it is figured on a percentage basis. In many cases, the actual forest areas offer a different picture to the game management technician. True solid stands of pine in large enough blocks to affect game significantly are rare over most of the area. For the most part, the area is a vast pine hardwood region with southern red oak (*Quercus falcata*) and its associates making up a great portion of the types present. (Plate 12).

The mixed bottomland hardwood types confined to the drainage courses and the lower areas form an intricate interlacing pattern throughout the vast pine-hardwood forest. In no place outside the Red River Valley are there found large blocks of hardwoods, but the smaller units are so prevalent that the total sum is nearly 30 percent of the whole forest. This mixed bottomland type is predominately mixed oaks and hardwoods with red gum fairly prominent. Beech (*Fagus grandifolia*), maple (*Acer*

TABLE 10

NORTHWEST LOUISIANA UPLANDS

Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest breakdown in acres
Bienville	528,640	148,686	357,128	149,994 a 124,995 b 82,139 c
Bossier	538,240	143,100	368,443	117,902 a 95,795 b 154,746 c
Caddo	576,000	222,724	265,523	87,623 a 58,415 b 119,485 c
Caldwell (2/3)	209,112	26,279	182,833	103,605 a 79,228 b ....
Catahoula (1/3)	266,555	21,000	245,555	129,682 a 115,873 b ....
Claiborne	490,240	193,967	248,652	101,947 a 74,596 b 72,109 c
DeSoto	575,360	175,023	348,151	132,297 a 121,853 b 94,001 c
Grant	428,800	53,641	362,945	221,396 a 54,442 b 87,107 c
Jackson	373,120	67,259	315,973	110,591 a 113,750 b 91,632 c
LaSalle	408,320	14,916	365,983	150,053 a 102,475 b 113,455 c
Lincoln	300,160	148,703	131,760	52,704 a 44,798 b 34,258 c
Natchitoches	830,080	135,298	624,249	343,337 a 99,880 b 181,032 c
Ouachita (W.2/3)	249,600	70,278	126,049	37,141 a 66,322 b 22,586 c
Rapides (N.1/5)	140,424	35,092	104,932	72,976 a 18,244 b 13,712 c
Red River	264,320	124,323	132,195	39,659 a 29,082 b 63,454 c

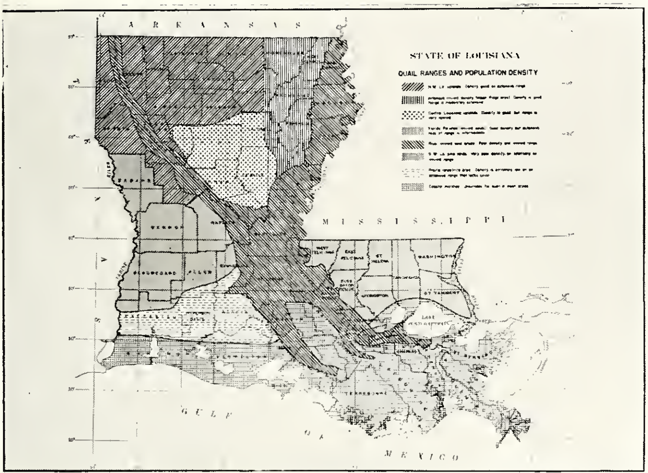


FIGURE 14

TABLE 10—(Cont'd)
NORTHWEST LOUISIANA UPLANDS
Statistical Data On Land Use

Union	579,840	143,048	405,770	150,135 a 121,731 b 133,904 c
Webster	400,640	118,674	203,078	69,047 a 54,831 b 79,200 c
Winn	608,000	42,879	543,531	250,024 a 152,189 b 141,318 c
TOTAL	7,767,451	1,884,890	5,332,750	2,320,113 a 1,528,449 b 1,484,138 c 5,332,750

a. Pine—43.5% of total.
b. Pine hardwoods—28.6% of total.
c. Bottomland hardwoods—27.8% of total.

rubrum tridens), hickory (*Carya spp.*), sweetbay (*Magnolia virginiana*), red bud (*Cercis canadensis*), Dogwood (*Cornus drummondii* & *C. florida*) and other types associated with upland areas are prevalent in both bottomlands and in the pine hardwood areas.

The under-story structure for the area consists of the following smaller trees, shrubs, and associated plants. Huckleberry (*Vaccinim arboreum* & *Vaccinium sp.*), silverbell (*Halesia diptera*),

TABLE 11

SUMMARY OF FOREST TYPES – NORTHWEST LOUISIANA UPLANDS

	Percent	All types	Type numbers*	Percent of each type	Occurrence	Indicator species
PURE PINE	43.6	Longleaf pine, shortleaf, and loblolly pine	63 64 68 69 70	37.8	On crests of hills and ridges, well-drained sites. On Orangeburg and Ruston soils.	*Pinus palustris, P. echinata, P. taeda, Quercus stellata, Q. marilandica.*
		Shortleaf–loblolly pine–hardwoods	65 66 69 70 71 72	29.4	Same as above pine-hardwoods —usually second growth on slopes.	*Pinus echinata, P. taeda, Quercus falcata, Q. alba, Carya spp., Fagus grandifolia, Magnolia virginiana, Liquidambar styraciflua.*
PINE-HARDWOODS	28.6	Upland hardwoods	77 79 80	12.5	Intermingled with pine-hardwoods–on better soils. Seldom in solid stands.	*Fagus grandifolia, Magnolia virginiana, M. grandiflora, Carya spp., Quercus alba, Q. nigra, Q. Falcata.*
MIXED BOTTOMLAND HARDWOODS	27.8	Bottomland hardwoods	80 81 82 84	20.3	Lower bottomlands along Red and Ouachita Rivers and on smaller streams.	*Liquidambar styraciflua, Quercus pagoda, Q. prinus, Q. nigra, Q. stellata, Carya spp., Nyssa sylvatica, Gleditsia triacanthos, Q. alba, Ulmus americanus, Acer rubrum.*

* Standard type numbers of the cover types of the eastern United States.

PLATE 12

Southern red oak and scrub oaks dominate some north Louisiana areas after the pines are cut. This range is suitable for deer and squirrel.

sweetleaf (*Symplocos tinctoria*), snowbell (*Styrax americana*), French mulberry (*Callicarpa americana*), possumhaw (*Viburnum nudum*), and arrowwood (*V. dentatum*). (See Tables 11 and 12 for a complete summary of forest composition).

The entire forest area of the Northwest Louisiana Upland offers excellent range for forest game, but this condition has only existed in recent years since a second growth has replaced the cut-over areas. (Plates 12 & 13). The location of forest lands, however, makes the south central part of the division more suitable for large forest game than the remainder of the area. This will be discussed in detail under the individual game types.

Farming and farming practices in north Louisiana are of two types. A small part of the over-all farm lands in the division is confined to the Red River Valley, where plantation type cotton and cattle farms are the rule. This has been discussed above in another section. The remainder of the farm area, consisting of some 1,800,000 acres of smaller hill type farms, makes up about 24 per cent

TABLE 12

MORE COMMON FOREST PLANT SPECIES OF THE NORTHERN LOUISIANA UPLANDS

DOMINANT

LOBLOLLY PINE *(Pinus taeda)*
SHORTLEAF PINE *(Pinus echinata)*
BALD CYPRESS *(Taxodium distichum)*
RED CEDAR *(Juniperus virginiana)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(Salix interior)*
BLACK WALNUT *(Juglans nigra)*
PECAN *(Carya illinoensis)*
BUTTERNUT HICKORY *(Carya cordiformis)*
WHITE HICKORY *(Carya tomentosa)*
SHAGBARK HICKORY *(Carya ovata)*
SAND HICKORY *(Carya pallida)*
LOUISIANA HICKORY *(Carya ludoviciana)*
PIGNUT HICKORY *(Carya glabra)*
BEECH *(Fagus grandifolia)*
CHINQUAPIN *(Castanea pumila)*
WHITE OAK *(Quercus alba)*
POST OAK *(Quercus stellata)*
COW OAK *(Quercus prinus)*
SOUTHERN RED OAK *(Quercus falcata)*
BLACKJACK OAK *(Quercus marilandica)*
WATER OAK *(Quercus nigra)*
OBTUSA OAK *(Quercus obtusa)*
AMERICAN ELM *(Ulmus americana)*
WINGED ELM *(Ulmus alata)*
CEDAR ELM *(Ulmus crassifolia)*
HACKBERRY *(Celtis laevigata)*
MULBERRY *(Morus rubra)*
MAGNOLIA *(Magnolia grandiflora)*
SWEETBAY *(Magnolia virginiana)*
REDBAY *(Persea borbonia)*
SWAMP REDBAY *(Persea palustris)*
REDGUM *(Liquidambar styraciflua)*
SYCAMORE *(Platanus occidentalis)*
SUGAR MAPLE *(Acer saccharophorum)*
RED MAPLE *(Acer rubrum)*
BLACK GUM *(Nyssa sylvatica)*
WHITE ASH *(Fraxinus americana)*

SUB-DOMINANT

WAXMYRTLE *(Myrica cerifera)*
HORNBEAM *(Carpinus caroliniana)*
HOPHORNBEAM *(Ostrya virginiana)*
RIVER BIRCH *(Betula nigra)*
CUCUMBER TREE *(Magnolia acuminata)*
SASSAFRAS *(Sassafras albidum)*
VIRGINIA WILLOW *(Itea virginica)*
HAWTHORN *(Crataegus spp.)*
CRAB APPLE *(Malus spp.)*
CHOKEBERRY *(Aronia arbutifolia)*
PLUMS *(Prunus spp.)*
REDBUD *(Cercis canadensis)*
IVY & SUMAC *(Rhus spp.)*
DECIDUOUS HOLLY *(Ilex decidua)*
YAUPON *(Ilex vomitoria)*
AMERICAN HOLLY *(Ilex opaca)*
BUCKEYE *(Aesculus pavia)*
INDIANCHERRY *(Rhamnus caroliniana)*
DOGWOOD *(Cornus drummondii & C. florida)*
WINTERHUCKLEBERRY *(Vaccinium arboreum)*
SUMMERHUCKLEBERRY *(Vaccinium elleottii)*
SWEETLEAF *(Simplocos tinctoria)*
SILVERBELL *(Halesia diptera)*
SNOWBELL *(Styrax spp.)*
FRINGETREE *(Chionanthus virginica)*
FRENCH-MULBERRY *(Callicarpa americana)*
BUTTONBUSH *(Cephalanthus occidentalis)*
POSSUMHAW *(Viburnum nudum)*
ARROW-WOOD *(Viburnum dentatum)*

PLATE 13

A typical second-growth pine-hardwoods forest of the Northwest Louisiana Uplands. A brushy under-story makes this suitable for deer. Such relatively open areas, however, cannot hold deer if dog hunting is prevalent.

of the entire area. From this, it is seen that the area of farm land is relatively small in comparison with the area of forest in the division, but the large size of the ecological division is such that more farm game range occurs here than in any other section of the State. (See Table 3).

Farming throughout this area is excellent from a farm game range standpoint. Small, non-mechanized, crudely worked, hill type farms scattered through this mixed pine-hardwoods area offer the maximum in natural and planted food and cover for farm game. Cotton is the staple crop but, because of the poor nature of the soil, for a farm family to subsist on the land, much diversification is practiced. Pasture and cattle production is now being advocated for the area and should it increase markedly, a deline in good farm game range will occur. In recent times, many of these hill farms have been abandoned, causing a change in the type

PLATE 14

Semi-open pine-hardwood areas. Good turkey range especially when interlaced by numerous hardwood creek bottoms.

of game range. The details of these changes will be discussed as they apply to each species.

SUMMARY

The major characteristics of the northwest Louisiana hill lands division as they will affect game types and populations may be listed as follows:

1. The extensive forest of the south central part of this division consists of some of the best potential forest game range in the State.
2. Forests in the remainder of the area are too broken up by farmlands to support big numbers of large forest game. These forests are excellent squirrel range.
3. In those areas where hill farms are prevalent, the farm game conditions are the best in the State. (Plate 15).
4. Farm areas in the Red River Valley are highly mechanized, clean and for the most part, are lacking in sufficient cover and food to support large farm game populations.
5. Little or none of the area is ever subjected to serious flooding.

SOUTHEAST TERRACE LANDS (FLORIDA PARISHES)

The Southeast Louisiana Terrace Lands include all of the Florida Parishes. (See maps – Figs. 11 & 12 – & Tables 3 & 13). This area consists of more than 2,800,000 acres and although based on the same terrace units, is separated from the Southwest Louisiana Terrace Lands ecologically for the following reasons: (1) It is separated by a wide natural ecological barrier from the southwest section, the Mississippi and Atchafalaya Bottomlands. (2) The soils in this area, particularly in the more western Florida Parishes, are more fertile and support a different more dense second-growth forest. (3) Better soils have resulted in more extensive farming of a particular nature.

The forests of the Southeast Louisiana Terrace cover over 1,900,000 acres or more than 68 per cent of the area. (See Tables 3 & 14). Three major forest types occur in the area; they are pine, pine-hardwood and mixed bottomland hardwoods. The forest lands of the area may be divided into two sections because

PLATE 15

Two views of good quail characteristic of the smaller diversified pineland hill farms. Notes abundance of food and cover.

TABLE 13

SOUTHEAST LOUISIANA TERRACE LANDS

Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest breakdown in acres
E. Baton Rouge	295,680	113,809	133,056	.... a 15,967 b 117,089 c
E. Feliciana	290,560	153,704	144,888	.... 44,915 b 99,973 c
Livingston*	280,618	38,953	236,551	144,983 a 91,568 b ....
St. Helena	268,800	55,059	201,131	126,712 a 40,227 b 34,192 c
St. Tammany	581.120	65,544	472,037	330,426 a 14,161 b 127,450 c
Tangipahoa*	454,468	83,510	336,896	285,371 a 51,525 b ....
Washington	425,600	104,882	300,610	174,354 a 54,110 b 72,146 c
W. Feliciana	262,400	97,994	136,748	.... 24,615 b 112,133 c
TOTAL	2,859,246	713,455	1,961,917	1,061,846 a 337,088 b 562,983 c 1,961,917

a Pine—54.1% of total.

b Pine hardwoods—17.2% of total.

c Hardwoods—28.7% of total.

* Hardwoods from these parishes in Table 4.

of differences in composition and in general distribution. In the easternmost parishes of Washington, St. Tammany, and Tangipahoa, pines and pine-hardwoods predominate on the poorer sandy soils. Large acreages of this area, once clothed in longleaf and slash pine, are now denuded pine barrens producing only wiregrass, sedges, gallberry, and myrtle. Those areas that have been artificially reforested are clothed in relatively solid stands of loblolly or slashpine, usually of such density as to shade out most of the under-story. Along streams, pine-hardwoods and mixed bottomland hardwoods prevail. These include such indicator species as beech (*Fagus grandifolia*), magnolia (*Magnolia grandiflora*), sweetbay (*M. virginiana*), hickory (*Carya spp.*), water oak (*Quercus nigra*), red oak (*Q. falcata*), sycamore (*Platanus occidentalis*), black gum (*Nyssa sylvatica*), hornbeam (*Carpinus caroliniana*), river birch (*Betula nigra*), arrow-wood (*Viburnum dentatum*), and willow (*Salix nigra*). This bottomland area becomes quite extensive in the Honey Island area of the lower Pearl River. Characteristic species throughout the bottomlands of this area are various oaks, beech, maple, magnolia, hickory, bitter pecan, ash, redgum, sycamore, elm, and cypress. (See list in Table 15). A few of the more than 30 sub-dominant trees and under-story shrubs are dogwoods, haws, chinquapin, buckeye, French-mulberry, swamp privet, yaupon, and holly. (Tables 14 and 15). Various vines and grasses occur throughout these mixed bottomland hardwood and pine-hardwood areas.

In the western parishes of Livingston, St. Helena, East Baton Rouge, and East and West Feliciana, better soils have produced heavy second growth pine-hardwoods and mixed hardwood forests. The general types or species listed above are the same in this area, but much more dense. Livingston and St. Helena parishes are practically solidly clothed in pine-hardwoods and mixed hardwoods. East Baton Rouge and the Felicianas have a greater dominance of oaks, beech, yellow poplar, magnolia, bay, hickory, and the upland hardwoods. This area also has more open land in farms or meadows. Insofar as the forest game is concerned, the Pearl and Bogue Chitto bottoms offer the only range in the eastern half of the area but the more dense forests in Livingston and St. Helena Parishes offer ideal deer, turkey and squirrel range.

The farm lands of the Southeast Terrace Lands occupy 713,455 acres or 24.9 per cent of the division. For the most part, farming is carried on in two areas and is of two distinct types. In the more eastern parishes dairy farming, cattle farming, and truck farming are the main types. This area is especially productive of strawberries and beans. In Livingston and St. Helena, strawberry and truck farming are dominant, but extensive woodlands preclude large amounts of farming. In the Felicianas and

TABLE 14

SUMMARY OF FOREST TYPES–FLORIDA PARISHES

	Percent	All types	Type numbers	Percent of each type	Occurrence	Indicator species
PURE PINE	54.1	Longleaf-slash, and loblolly pine	63 64 65 69 72 73 74	54.1	Rolling hills and poorly drained flats in eastern part of area.	*Pinus palustris* (cut-over), *P. caribaea*, *P. taeda*, *Q. stellata*, *Q. marilandica*, *Q. falcata*, *Q. laevis.*
LOBLOLLY-HARDWOODS	17.2	Loblolly pine and mixed hardwoods	69 70 72 77 79 80 81	17.2	In second-growth areas and transitional between bottomland and pine.	*Pinus taeda*, *P. glabra*, *P. palustris*, *Quercus falcata*, *Q. stellata*, *Q. alba*, *Q. nigra*, *Liquidambar styraciflua*, *Carya spp.*
		Upland hardwoods	77 79 80 81	4.0	Confined to bluff and terrace hills of West Feliciana Parish.	*Magnolia grandiflora*, *M. virginiana*, *Liriodendron tulipifera*, *Carya spp.*, *Fagus grandifolia*, *Quercus alba*, *Q. shumardii*, *Acer saccharophorum*, *Cornus florida*, *Cercis canadensis.*
MIXED HARDWOODS	28.7	Mixed bottomland hardwoods	79 80 81 82 83 84 85 86 87	24.7	Along all streams and over the southern part of the Felicianas and most of East Baton Rouge Parish on the better soils.	*Liquidambar styraciflua*, *Quercus nigra*, *Q. prinus*, *Q. pagoda*, *Q. shumardii*, *Fagus grandifolia*, *Magnolia virginiana*, *Nyssa sylvatica*, *Carya spp.*, *Ulmus americana*, *Carpinus carolinana.*

TABLE 15

MORE COMMON PLANT SPECIES OF SOUTHEAST LOUISIANA TERRACE

DOMINANT

LONGLEAF PINE *(Pinus plaustris)*
SLASH PINE *(Pinus caribaea)*
LOBLOLLY PINE *(Pinus taeda)*
SHORTLEAF PINE *(Pinus echinata)*
SPRUCE PINE *(Pinus glabra)*
SONDEREGGER PINE *(Pinus sondereggeri)*
BALDCYPRESS *(Taxodium distichum)*
PONDCYPRESS *(Taxodium ascendens)*
RED CEDAR *(Juniperus virginiana)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(Salix interior)*
PECAN *(Carya illinoensis)*
BITTERNUT HICKORY *(Carya cordiformis)*
SHAGBARK HICKORY *(Carya ovata)*
SAND HICKORY *(Carya pallida)*
SWAMP HICKORY *(Carya leiodermis)*
PIGNUT HICKORY *(Carya glabra)*
BEECH *(Fagus grandifolia)*
CHINQUAPIN *(Castanea pumila)*
WHITE OAK *(Quercus alba)*
POST OAK *(Quercus stellata)*
COW OAK *(Quercus prinus)*
LIVE OAK *(Quercus virginiana)*
SOUTHERN RED OAK *(Quercus falcata)*
SHUMARD OAK *(Quercus shumardii)*
TURKEY OAK *(Quercus laevis)*
BLACKJACK OAK *(Quercus marilandica)*
WATER OAK *(Quercus nigra)*
OBTUSA OAK *(Quercus obtusa)*
WILLOW OAK *(Quercus phellos)*
AMERICAN ELM *(Ulmus americana)*
WINGED ELM *(Ulmus alata)*
HACKBERRY *(Celtis laevigata)*
MULBERRY *(Morus rubra)*
MAGNOLIA *(Magnolia grandiflora)*
SWEETBAY *(Magnolia virginiana)*
TULIP TREE *(Liriodendron tulipifera)*
REDBAY *(Persea borbonia)*
SWAMP REDBAY *(Persea palustris)*
REDGUM *(Liquidambar styraciflua)*
SYCAMORE *(Plantanus occidentalis)*

SUB-DOMINANT

PALMETTO *(Sabal minor)*
WAX MYRTLE *(Myrica cerifera)*
DWARF WAXMYRTLE *(Myrica pumila)*
NORTHERN-CANDLEBERRY *(Myrica carolinensis)*
HORNBEAM *(Carpinus caroliniana)*
HOPHORNBEAM *(Ostrya virginiana)*
RIVER BIRCH *(Betula nigra)*
BLACK ALDER *(Alnus rugosa)*
CUCUMBERTREE *(Magnolia acuminata)*
STARBUSH *(Illicium floridanum)*
PAWPAW *(Asimina triloba)*
SASSAFRAS *(Sassafras albidum)*
HYDRANGER *(Hydrangea quecifolia)*
VIRGINIAWILLOW *(Itea virginica)*
HAWTHORNS *(Crataegus spp.)*
CRAB APPLE *(Malus spp.)*
CHOKEBERRY *(Aronia arbutifolia)*
PLUMS *(Prunus spp.)*
REDBUD *(Cercis canadensis)*
CANDLEBERRY *(Sebastiana ligustrina)*
SUMAC & IVY *(Rhus spp.)*
TITI *(Cyrilla racemiflora)*
DECIDUOUS HOLLY *(Ilex decidua)*
AMERICAN HOLLY *(Ilex opaca)*
GALLBERRY *(Ilex glabra)*
BUCKEYE *(Aesculus pavia)*
INDIANCHERRY *(Rhamnus caroliniana)*
DOGWOOD *(Cornus drummondii)*
CLETHRA *(Clethra tomentosa)*
SOURWOOD *(Oxydendrum arboreum)*
WILD AZALEA *(Rhododendron canescens)*
FETTERBUSH *(Lyonia lucida)*
WINTERHUCKLEBERRY *(Vaccinium arboreum)*
SUMMERHUCKLEBERRY *(Vaccinium eleottii)*
SWEETLEAF *(Symplocos tinctoria)*
SILVERBELL *(Halesia diptera)*
SNOWBELL *(Styrax spp.)*
BUTTONBUSH *(Cephalanthus occidentalis)*

TABLE 15—(Cont'd)

MORE COMMON PLANT SPECIES OF SOUTHEAST LOUISIANA TERRACE

DOMINANT	*SUB-DOMINANT*
SUGAR MAPLE *(Acer saccabrophorum)*	POSSUMHAW *(Viburnum nudum)*
BLACKGUM *(Nyssa sylvatica)*	ARROW WOOD *(Viburnum dentatum)*
WHITE ASH *(Fraxinus americana)*	FRINGETREE *(Chionanthus virginica)*
	FRENCH-MULBERRY *(Callicarpa americana)*

East Baton Rouge Parish, old plantations that once produced cotton, grains, and some sugar are now predominately in pasture and cattle production. Some cotton farming still occurs, but for the most part, idle or pastured areas occur where there is no forest. From a farm game standpoint, the area does not produce as well as it once did; however, in parts of the Feliciana Parishes and in St. Helena parish, excellent farm game habitats still occur. In any part of the area where diversified or crude farming is practiced or where natural foods and cover are available, there will be good farm game conditions.

Summary

The major characteristics of the Southeast Louisiana Terrace Lands which will, in general, control the game types and populations are listed from the above discussion as follows:

1. Most of the forest lands of the area are of an excellent type insofar as forest game is concerned.

2. Large blocks of forest suitable for deer and turkey are confined to the Livingston, St. Helena area and to the Bogue Chitto-Pearl River bottoms.

3. The cut-over pine lands and extensive farms in parts of the area offer widespread farm and upland game range, but grazing, clean farming, and truck farming prevent full productivity of game.

4. Most of the area is high and not subject to flooding.

SOUTHWEST LOUISIANA TERRACE LANDS (SOUTHWEST LOUISIANA PINE LANDS)

The Southwest Terrace or Pine Lands is an area of over 3,600,000 acres making up all or parts of the parishes of Sabine, Vernon, Rapides, Allen, Beauregard, and Evangeline. (See maps—Figs. 11 & 12, and Table 3 & 76). This area, once clothed in a nearly solid stand of longleaf pine, is now the least productive area of the State from an economic standpoint. The timber has been completely cut; grass fires, open range grazing, and poor sandy soils have prevented serious reforestation. Farming on such soil is at a minimum in extent and productivity.

TABLE 16

SOUTHWEST LOUISIANA TERRACE LANDS
Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest breakdown in acres
Allen	496,000	42,885	421,104	265,295 a 58,955 b 96,854 c
Beauregard	757,760	89,733	667,756	534,205 a 60,098 b 73,453 c
Calcasieu (N. ¼)*	235,344	35,000	200,344	200.344 a ....
Evangeline (W. 1/3)*	148,769	25,000	123,769	54,149 a 69,260 b ....
Rapides (W. ½)*	483,870	76,947	406,923	282,994 a 70,748 b 53,181 c
Sabine	658,560	83,365	531,158	292,137 a 127,478 b 111,543 c
Vernon	870,400	53,516	738,507	494,800 a 88,621 b 155,086 c
TOTAL	3,650,703	406,446	3,089,561	2,123,924 a 475,520 b 490,117 b
				3,089,561

a Pine—68.7% of total (1,132,072 acres cut-over barrens).

b Pine hardwoods—15.4% of total.

c Bottomland hardwoods—15.9% of total.

* See other tables for other sections of these parishes.

Over 3,000,000 acres of the total area is classed as forest lands and may be broken down into 2,123,924 acres of pine lands, 475,520 acres of pine-hardwoods and 490,117 acres of oaks and mixed bottomland hardwoods. For the most part, the extensive area designated as pineland is a barren denuded region with few seed trees. (Plates 16 & 17). The surface is covered with a perennial grass rough. In the northern parts, scrub oaks such as post oak (*Quercus stellata*), blackjack (*Q. marilandica*), and sandjack (*Q. incana*) are very common. In the southern area where drainage is poorer, myrtle becomes prominent. This vast expanse of barren land is cut-over and interlaced by spring heads and streamlets locally known as "green heads" or "bay galls". It is along these and larger streams that the pine-hardwoods become evident as a transitional zone between the bottoms and hills. Hardwoods are found only in the bottoms along the largest streams, and in the flatwoods areas where water stands. This latter condition usually occurs in scattered islands over the pine flatwoods and are locally known as "bays".

In the small "green heads", the more dominant plants are sweetbay (*Magnolia virginiana*), redbay (*Persea borbonia*), alder (*Almus rugosa*), waxmyrtle (*Myrica cerifera*), possumhaw (*Viburnum nudum*), and Virginia-willow (*Itea virginica*).

As these streamlets become larger, typical pine-hardwoods with the various oaks, hickories, redgum, beech, and magnolia occur. Along stream banks, river birch (*Betula nigra*), arrowwood (*Virburnum dentatum*), ironwood (*Carpinus caroliniana*), greenbrier (*Smilax spp.*) and switch cane are the primary indicator species. The larger river bottoms of the area contain the oak and mixed hardwood types as described for the Southeast Terrace Lands. In addition to this general composition, the island-like "bays" described above may range in size from a very few acres to 10,000 or more. In these areas, the prevalent species are various wet land oaks, sweetbay, blackgum, swamp red maple, green ash, redbay, yaupon, arrow-wood, huckleberries and, on higher elevations, loblolly pine and oaks. Such areas with the larger river bottoms offer the only suitable range for large forest game in the entire section. For a more complete listing of forest types and species, see Tables 17 and 18.

Farming in the Southwest Terrace or Pine Lands is at a minimum. Only 11.3 per cent of the total area is in farms but

PLATE 16

Typical cut-over longleaf pinelands. Both cover and food are at a premium here. Any game in such areas is usually confined to the small wooded draws shown in the background.

PLATE 17

Aerial photograph (bottom) and upper picture indicates the presence of more cover in cut-over areas than is evidenced in Plate 16. This is generally good upland range where food is available. It is well suited for quail development.

TABLE 17

SUMMARY OF FOREST TYPES – SOUTHWEST LOUISIANA TERRACE LANDS

	Percent	All types	Type* numbers	Percent of each type	Occurrence	Indicator Species
PURE PINE (cut-over)	68.7	Longleaf pine barrens—scrub oaks	63 64 65	36.6	On cut-over pine hills primarily wire grass and sedges. Scrub oaks in northern part of section. Scattered seed pine.	*Pinus palustris* (cut-over, sparse), *Quercus marilandica*, *Q. falcata*, *Q. stellata*, Grasses-*Andropogon* spp., *Muhlenbergia* spp.
PURE PINE		Longleaf-loblolly pine scrub oaks	64 65 69 70 73	32.1	Open stands except where reproduction has occurred on plantations.	*Pinus palustris*, *P. taeda* (thicker than above), *Q. falcata*, *Q. stellata*, *Q. marilandica*.
PINE–HARDWOOD	15.4	Loblolly pine–mixed hardwoods	69 70 79 80 81	15.4	Transitional between creek bottoms and hills–along smaller streams–on ridges in lower areas.	*Pinus taeda*, *Q. falcata*, *Q. alba*, *Carya* spp., *Liquidambar styraciflua*, *Magnolia virginiana*, *Q. nigra*.
MIXED BOTTOMLAND HARDWOODS	15.9	Mixed bottomland hardwoods	79 80 81 83 84 87 88	15.9	Predominantly along streams or in local lower areas known as "bays".	*Liquidambar styraciflua*, *Nyssa sylvatica*, *Fagus grandifolia*, *Magnolia virginiana*, *Carya* spp., *Quercus nigra*, *Q. falcata*, *Betula nigra*, *Carpinus caroliniana*.

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* Standard type numbers of the cover types of the eastern United States.

TABLE 18

MORE COMMON FOREST PLANT SPECIES OF THE SOUTHWEST LOUISIANA TERRACE LANDS

(Southwest Louisiana Pinelands)

DOMINANT
LONGLEAF PINE *(Pinus palustris)*
SLASH PINE *(Pinus caribaea)*
LOBLOLLY PINE *(Pinus taeda)*
SHORTLEAF PINE *(Pinus echinata)*
SONDEREGGER PINE *(Pinus sonderegger)*
BALDCYPRESS *(Taxodium distichum)*
RED CEDAR *(Juniperus virginiana)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(Salix interior)*
PECAN *(Carya illinoensis)*
BITTERNUT HICKORY *(Carya cordiformis)*
SHAGBARK HICKORY *(Carya ovata)*
SAND HICKORY *(Carya pallida)*
SWAMP HICKORY *(Carya leiodermis)*
PIGNUT HICKORY *(Carya glabra)*
BEECH *(Fagus grandifolia)*
CHINQUAPIN *(Castanea pumila)*
WHITE OAK *(Quercus alba)*
POST OAK *(Quercus stellata)*
COW OAK *(Quercus prinus)*
SOUTHERN RED OAK *(Quercus falcata)*
BLACKJACK OAK *(Quercus marilandica)*
WATER OAK *(Quercus nigra)*
OBTUSA OAK *(Quercus obtusa)*
AMERICAN ELM *(Ulmus americana)*
WINGED ELM *(Ulmus alata)*
HACKBERRY *(Celtis laevigata)*
MULBERRY *(Morus rubra)*
MAGNOLIA *(Magnolia grandiflora)*
SWEETBAY *(Magnolia virginiana)*
TULIPTREE *(Liriodendron tulipifera)*
REDBAY *(Persea borbonia)*
SWAMP REDBAY *(Persea palustris)*
RED GUM *(Liquidambar styraciflua)*
SYCAMORE *(Platanus occidentalis)*
SUGAR MAPLE *(Acer saccharophorum)*
BLACK GUM *(Nyssa sylvatica)*
WHITE ASH *(Fraxinus americana)*
SUB-DOMINANT
PALMETTO *(Sabal minor)*
WAXMYRTLE *(Myrica cerifera)*
DWARF WAXMYRTLE *(Myrica pumila)*
NORTHERN-CANDLEBERRY *(Myrica carolinensis)*
HORNBEAM *(Carpinus caroliniana)*
HOPHORNBEAM *(Ostrya virginiana)*
RIVER BIRCH *(Betula nigra)*
BLACK ALDER *(Alnus rugosa)*
CUCUMBER TREE *(Magnolia acuminata)*
PAWPAW *(Asimina triloba)*
SASSAFRAS *(Sassafras albidum)*
VIRGINIAWILLOW *(Itea virginica)*
HAWTHORN *(Crataegus spp.)*
CRAB APPLE *(Malus spp.)*
CHOKEBERRY *(Aronia arbutifolia)*
PLUMS *(Prunus spp.)*
RED BUD *(Cercis canadensis)*
SUMAC & IVY *(Rhus spp.)*
DECIDUOUS HOLLY *(Ilex decidua)*
AMERICAN HOLLY *(Ilex opaca)*
GALLBERRY *(Ilex glabra)*
BUCKEYE *(Aesculus pavia)*
INDIANCHERRY *(Rhamnus caroliniana)*
WILD AZALEA *(Rhododendron canescens)*
FETTERBUSH *(Lyonia lucida)*
WINTERHUCKLEBERRY *(Vaccinium arboreum)*
SUMMERHUCKLEBERRY *(Vaccinium elliottii)*
SWEETLEAF *(Symplocos tinctoria)*
SILVERBELL *(Halesia diptera)*
SNOWBELL *(Styrax* spp.*)*
BUTTONBUSH *(Cephalanthus occidentalis)*
POSSUMHAW *(Viburnum nudum)*
ARROW WOOD *(Viburnum dentatum)*
FRINGETREE *(Chionanthus virginica)*
FRENCH-MULBERRY *(Callicarpa americana)*
DOGWOOD *(Cornus florida* & *C. drummondii)*

where farming occurs, it offers excellent farm game habitat. Diversified cruder type hill farming in the area offers the maximum in natural food and cover that the soils can produce. The limited amount of farming in the area, however, produces only a fraction of the farm game. The majority of the quail, rabbit, and doves are of necessity confined to the grasslands of the cut-over pine woods. This vast area of cut-over lands as an upland game habitat will be considered in detail later in this report.

The characteristics which determine the types and amounts of game that are prevalent in the area are as follows:

1. The vast cut-over pine areas make this area into one of upland and farm game rather than forest game at the present time.

2. Except for a few large bays, like West Bay in Allen Parish, and the larger river bottoms, range suitable for deer and large game is limited.

3. Poor soils make farming in the area negligible, but where the farms do occur, good habitat is offered.

4. Generally poor soils, few farms and uncontrolled fires or high roughs of grass are the greatest limiting factors to upland game abundance in the area.

SOUTHWEST LOUISIANA PRAIRIE LANDS

The Southwest Louisiana Prairie Lands consisting of some 2,350,000 acres are the only extensive natural prairie areas in the State. This area making up all or parts of Calcasieu, Jefferson Davis, Acadia, Evangeline, and Allen Parishes has never contained large forested areas, and has always been known as a prairie or grassland. (See maps–Figs. 11 and 12-and Tables 3 and 19). All the forested lands in the area comprise only 18.7 per cent of the total area. These forested areas are predominately confined to stream courses or fringes of the lower swampy areas. One can look for miles and see only scattered clumps or fringes of trees over a flat plowed or grass prairie. These small blocks of forests are of three main types. Pine and pine-hardwoods are found on the northern fringes of the section where it joins the Southwest Louisiana Pine Lands. Much of this area is cut and is now substantially a prairie. The bottomland hardwoods are typical oak and mixed hardwoods, redgum and oaks, and some cypress-tupelo all fringing the lower courses of the Vermilion River and Bayous Nezpique and des Cannes. (See Tables 20 & 21). Since the majority of this area is a treeless prairie, it cannot be expected to support forest game except for these narrow riverbottom strips which do contain a few squirrels. The remainder of the area is in prairie lands, either cultivated or uncultivated. Lands classified as farm lands make up

TABLE 19

SOUTHWEST LOUISIANA PRAIRIE

Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Total forest acreage	Forest break-down
Calcasieu (S. 4/5)*	535,216	130,023	107,878	.... a 36,987 b 70,891 c
Acadia	423,680	273,659	73,840	.... a 23,629 b 50,211 c
Jefferson Davis	421,120	282,729	87,740	63,173 a 9,651 b 14,916 c
Lafayette	181,120	146,092	23,779	.... 23,779 c
Evangeline (E. 2/3)*	281,311	137,585	134,084	.... 134,084 c
St. Landry (W 1/5)**	115,200	78,336	19,584	19,584 c
Vermilion***	392,393	347,862	44,531	44,531 c
TOTAL	2,350,040	1,396,286	491,436	63,173 a 70,267 b 357,996 c 491,436

* Part of these parishes in Table 16.

** Part of this parish in Table 4.

*** Marsh section of this parish in Table 22.

a Pine

b Pine hardwoods

c Bottomland hardwoods

59.4 per cent of the area and amounts to 1,396,286 acres. The remainder of the land is idle. This whole region has a poorly drained sub-soil which makes it ideal for wet land crops. This has resulted in rice production and grazing becoming the two principal land use practices. This resultant type of farming fails to produce natural or planted food and cover suitable for farm game in this area. Because of this, farm game is at an extremely low ebb. The only compensating factor as far as any game in the area is concerned is the use of flooded rice fields by wintering waterfowl. As a whole, the entire area may be characterized by the following ecological criteria as they affect game conditions.

1. Vast prairie lands either cultivated or uncultivated mark the

TABLE 20

SUMMARY OF FOREST TYPES – SOUTHWEST LOUISIANA PRAIRIE LANDS

	Percent	Types	Type Nos.*	Percent of each type	Occurrence	Indicator species
FOREST LAND	20.9	Bottomland hardwoods, oaks–mixed hardwoods, hackberry–elm–ash, cypress–tupelo	61 80 81 82 83 85 88 89 94 95	72.8	Along streams and bordering coastal marsh.	Poorly drained sites: *Acer drummondii, Fraxinus pennsylvanica, Quercus nigra, Liquidambar styraciflua, Q. phellos, Nyssa sylvatica, Taxodium distichum.* Better drained: *Q. nigra, Q. pagoda, Q. stellata, Q. prinus, Crataegus* spp.
		Pine–hardwoods	69 70 79 80 81	14.3	Northern edge of area along streams and second growth.	*Pinus taeda, Q. stellata, Q. falcata, Carya* spp. (See other pine-hardwood sections).
		Pure pine (cut-over longleaf and loblolly)	63 64 69	12.9	Northern edge of area near southwest terrace lands.	*Pinus taeda, Q. stellata, Q. falcata, Pinus palustris* (cut-over).
PRAIRIE LAND	79.1	Native grasslands, rice, and other cultivated crops		100	Over all area excepting stream edges and pinelands.	Native grass.

* Standard type numbers of the cover types of the eastern United States.

TABLE 21

MORE COMMON FOREST PLANT SPECIES OF THE SOUTHWEST LOUISIANA PRAIRIE

DOMINANT

LOBLOLLY PINE *(Pinus taeda)*
BALDCYPRESS *(Taxodium distichum)*
BLACK WILLOW *(Salix nigra)*
SANDBAR WILLOW *(Salix interior)*
PECAN *(Carya illinoensis)*
BEECH *(Fagus grandifolia)*
NUTTALL OAK *(Quercus nuttallii)*
SHUMARD OAK *(Quercus shumardii)*
SWAMP RED OAK *(Quercus pagoda)*
WHITE OAK *(Quercus alba)*
POST OAK *(Quercus stellata)*
OVERCUP OAK *(Quercus lyrata)*
COW OAK *(Quercus prinus)*
LIVE OAK *(Quercus virginiana)*
SOUTHERN RED OAK *(Quercus falcata)*
WATER OAK *(Quercus nigra)*
OBTUSA OAK *(Quercus obtusa)*
WILLOW OAK *(Quercus phellos)*
AMERICAN ELM *(Ulmus americana)*
WINGED ELM *(Ulmus alata)*
HACKBERRY *(Celtis laevigata)*
WATERELM *(Planera aquatica)*
MULBERRY *(Morus rubra)*
MAGNOLIA *(Magnolia grandiflora)*
TULIP TREE *(Liriodendron tulipifera)*
REDGUM *(Liquidambar styraciflua)*
SYCAMORE *(Platanus occidentalis)*
SUGAR MAPLE *(Acer saccharophorum)*
BLACK GUM *(Nyssa sylvatica)*

SUB-DOMINANT

WAXMYRTLE *(Myrica cerifera)*
HORNBEAM *(Carpinus caroliniana)*
HOPHORNBEAM *(Ostrya virginiana)*
RIVER BIRCH *(Betula nigra)*
PAWPAW *(Asimina triloba)*
SASSAFRAS *(Sassafras albidum)*
VIRGINIAWILLOW *(Itea virginica)*
HAWTHORN *(Crataegus spp.)*
CRABAPPLE *(Malus spp.)*
PLUMS *(Prunus spp.)*
REDBUD *(Cercis canadensis)*
SUMAC & IVY *(Rhus spp.)*
DECIDUOUS HOLLY *(Ilex decidua)*
AMERICAN HOLLY *(Ilex opaca)*
INDIANCHERRY *(Rhamnus caroliniana)*
DOGWOOD *(Cornus drummondii & C. florida)*
SWEETLEAF *(Symplocos tinctoria)*
SNOWBELL *(Styrax spp.)*
BUTTONBUSH *(Cephalanthus occidentalis)*
FRINGETREE *(Chionanthus virginica)*
FRENCH-MULBERRY *(Callicarpa americana)*

area as not suitable for forest game and only slightly suitable for upland or farm game.

2. Forested areas confined to stream edges, can support only small forest game.

3. The vast rice areas when flooded in winter make the area readily suitable for waterfowl.

THE COASTAL MARSHES

The Coastal Marsh Division is an area of over 4,000,000 acres bordering the Gulf of Mexico. It includes all or parts of eleven parishes. (See maps—Figs. 11 and 12 — and Tables 3 and 22). Forest lands and farm lands in the area are at a minimum; the former make up 1.8 per cent and the latter 4.0 per cent of the total area. The remainder of the area, over 3,800,000 acres, is in tidal marshes.

Forests here are chiefly confined to scrub cypress-tupelo and associated wet land hardwoods. On ridges, natural levees, and cheniers, live oaks are dominant. There is not enough of the area in forest to be of any significance for forest game.

Farm lands, like those in forest, are too small to be of importance in the area. The higher ridges and natural levees are farmed and some of the dryer marsh or prairie is used for grazing. The principal farm crops are rice, pasture, and citrus fruits; none of which is conducive to high farm game populations.

The three and a half million acres of marsh land in this division makes the area not only unique in the State, but in the United States as well. The detailed ecology of this area has been adequately described by O'Neil (1949) in relation to his studies on the muskrat. Following is a summary of the ecological characteristics of the area.

TABLE 22

COASTAL MARSH LANDS
Statistical Data On Land Use

Parish	Total area in acres	Total farm acreage less wood lots	Forest acreage	Marsh acreage
Cameron	924,160	113,403 x	1,004 c	809,753
Iberia	123,929	 xx	 xx	123,929
Jefferson	261,760	9,341 x	38,006	214,413
Lafourche	421,772	 xx	 xx	421,772
Orleans	127,360	3,384 x	6,790	45,000
Plaquemines	629,760	36,799	7,362	585,599
St. Bernard	326,400	11,393	24,607	290,400
St. Charles	194,560	28,374	69,162	97,024
St. Mary	233,391	 xx	 xx	223,391
Terrebonne	890,240	67,190	96,000	727,050
Vermilion	390,967	 xx	 xx	390,967
TOTAL	4,514,299	269,884	242,931	3,929,298

x Pasture predominant.

xx This portion placed in another geological division.

c All forests bottomland hardwoods.

In general, the coastal marshlands in Louisiana may be divided into fresh water, brackish water, and salt water areas as one progresses from high land to the open Gulf. These belts of marsh lie across the coast of Louisiana in varying widths. In addition to this division, the Coastal marshes may be divided from east to west into these areas: the Delta marshes surrounding the active delta at the mouth of the Mississippi River, the sub-delta marshes that start at Baptise Collette and Grand Pass in Plaquemines Parish and extend westward to Cow Island and Cheniere au Tigre in the west and the Prairie marshes which extend from Cheniere au Tigre in Vermilion Parish to the Texas line. (See Map—Fig. 12 and Table 23). The following description indicates the ecology of the areas.

THE DELTA MARSHES

This is the smallest of the marsh areas on the coast consisting of some 300,000 acres of predominately fresh marsh associated with the rapidly changing active delta of the Mississippi. Its primary plant types are cattail (*Typha spp.*), roseau cane (*Phragmites communis*), fresh-marsh three-cornered grass (*Scirpus americanus*), dog-tooth grass (*Panicum repens*), yellow cutgrass (*Zizaniopsis miliacea*), oystergrass (*Spartina alterniflora*), and delta duck potato (*Sagittaria platyphylla*). In addition to these native types, the delta is becoming completely dominated by alligator weed (*Alternanthera philoxeroides*), and water hyacinth (*Eichornia crassipes*). Each of these plant species may reach a period of dominance in the rapidly changing delta. The delta is made up of several stratified zones from the higher land to the newly formed flats at the tips of the passes. In each zone, some plant species may gain dominance because ecological conditions are best for it.

O'Neil (1949) has described five such zones that may be listed in order from the tips of the passes to the highest land in the area. They are: (1) The Delta Mud-flat Zone. Fresh-water three cornered grass *(Scripus americanus)* and delta duck potato *(Sagittaria platyphylla)* are the dominant species. (2) The New Natural Levee Zone. Slightly higher elevations bring oystergrass *(Spartina alterniflora)*, cutgrass *(Zizaniopsis miliacea)*, cattail (*T. latifolia)*, and roseau cane *(Phragmites communis)* into prominence. (3) Older Natural Levee Zone. Still higher elevations bring oystergrass and cattail into dominance here. Ponds formed on either side of such levees support alligator grass, duck moss *(Potamogeton foliosus)*, and widgeon grass *(Ruppia martima)*. (4)

TABLE 23

SUMMARY OF TYPE OF COASTAL MARSH

Marsh classes	Percent	Types within each class	Zones	Indicator species
Delta Marsh	7.0	Fresh water marsh	Delta Mud-flat Zone	*Scirpus americanus, Sagittaria platyphylla*
			New Natural Levee Zone	*Spartina alterniflora, Phragmites communis*
			Older Natural Levee Zones	*Spartina alterniflora, Typha latifolia*
			Stabilized Zone	*Zizaniopsis miliacea, Phragmites communis, Salix nigra*
			Delta Climax Zone	*Salix nigra, Celtis laevigata, Populus deltoides*
			Delta Sub-delta Transitional Zone	*Spartina patens, Juncus roemerianus, Distichlis spicata, Avicennia nitida*
Sub-delta Marsh	74.0	Fresh water	Firm Fresh Marsh	*Panicum hemitomon, Typha latifolia, Scirpus californicus, Cladium jamaicanse*
			Floating Fresh Marsh	*Sagittaria platyphylla*
		Brackish water	Firm Brackish Marsh	*Spartina patens, Scirpus olneyi*
			Floating Brackish Marsh	
		Salt marsh	Excessively Drained Tidal Salt Marshes	*Juncus roemerianus, Spartina patens, Spartina alterniflora*
Prairie Marsh	19.0	Fresh water		*Cladium jamaicense, Scripus californicus, Polygonum* spp., *Eleocharis quadrangulata*
		Brackish water		*Scirpus olneyi, S. robustus, Spartina patens, Zizaniopsis miliacea*
		Salt water		*Distichlis spicata, Spartina patens, Spartina alterniflora*

Stabilized Zone. This is an area of relatively stable elevation where cattail and oystergrass are succeeded by cutgrass *(Zizaniopsis milacea)* and roseau cane *(Phragmites communis)*. Some willows *(Salix nigra)* occur here. (5) Delta Climax Zone. This zone represents the highest development of the delta habitat. Here willow, hackberry *(Celtis laevigata)*, cottonwood *(Populus deltoides)*, and some live oaks *(Quercus virginiana)* dominate the crests of the levees. Lower wetter areas are dominated by cattail and alligator grass. (6) Delta-Subdelta Transitional Zone. This is a junction zone between the Delta and Sub-delta Marshes. Indicators of this area are salt-marsh species such as needle grass *(Juncus roemerianus)*, salt grass *(Distichlis spicata)*, sand rush *(Fimbristylis castanea)*, and honey mangrove *(Avicennia nitida)*.

THE SUB-DELTA MARSHES

The Sub-delta Marshes extend from Grand Pass in the Mississippi Delta to Cow Island and Cheniere au Tigre in Vermilion Parish in the western part of the State. (See map, Fig. 13). This large marsh area, the most productive fur range in the United States, consists of over 2,500,000 acres, most of this is fresh to brackish marsh. The stratification of this large area from the highland to the Gulf proper, ranging from fresh to salt, is described as follows:

Fresh Water Marshes: Near the high land well away from the Gulf salt tides have little effect and fresh water marshes occur. This area forms a more or less continuous but irregular belt across the northern edge of the Sub-delta Area. It consists of two types of fresh marsh: that which has a firm floor of clay; and that type which is floating because the clay pan has subsided. On both types of fresh marsh in this area, the dominant plant is paille fine *(Panicum hemitomon)*. Associated with it and in considerable prominence occur cattail, bulrush *(Scirpus californicus)*, and saw grass *(Cladium jamaicense)*, wapato *(Sagittaria latifolia)*, alligator grass, and water hyacinth.

Brackish Water Marshes: The area of brackish marshes forms an irregular belt across the central part of the Sub-delta marshes from east to west, and lies between the salt and fresh marshes. Here salt tides mix in large fresh water lakes to form the brackish condition characteristic of this area.

This area includes two classes. They are the floating, three-cornered grass, brackish marsh and the firm bottom, three-cornered grass brackish marsh. Both of these types are dominated in turn by wiregrass *(Spartina patens)* and brackish water, three-cornered grass *(Scirpus olneyi)*. *Scirpus olneyi* actually is sub-dominant to *Spartina patens* but becomes dominant after burns or when the *Spartina* has been killed. This condition has been created to a great extent by man-made burns for increasing muskrat production since *S. olneyi* marshes are the choice muskrat-producing marshes.

Salt Marshes: The salt marsh portion of the Sub-delta makes a belt along the Gulf that is well drained by tidal bayous and is subject to strong salt tides. The dominant plant types here are black rush *(Juncus roemerianus)*, wiregrass *(Spartina patens)*, oystergrass *(Spartina alterniflora)*, and occasional stalks of saw grass *(Cladium jamaicense)*. This type marsh produces only a few muskrats, some low grade raccoon and mink but it is the best clapper rail habitat in the State.

PRAIRIE MARSHES

The Prairie Marshes occuring in the westernmost part of the State are found in Cameron and Vermilion Parishes. This area consisting of 750,000 acres is somewhat different from the other marsh types. Geologically, it is much older and more stable. A clearly defined beach line is present and the marsh floor is relatively firm with a shallow layer of peat overlying the clay pan. Throughout this marsh, there is a series of higher ridges running parallel to the coast. These ridges are old beach formations and are locally called "chenieres". They support higher land types and as a rule, tend to separate the fresh, brackish, and salt-water parts of the prairie marsh. The Prairie Marsh, like the Sub-delta, can be divided into strata of marsh types from the high land to the Gulf. These are described below:

Salt Marshes: Near the beach in the prairie section, high salt tides and mineral deposits produce a salt marsh with a salt grass-wiregrass-oystergrass association. On the sea beach proper, buckbrush *(Baccharis halimifolia)*, hogcane *(Spartina cynosuriodes)*, and oystergrass *(Spartina alterniflora)* form the major vegetation types.

Brackish Marshes: Behind the salt marsh, sea-beach formation, a brackish marsh extends north to Creole and Grand Cheniere ridges where it is separated from the fresh water area. The brackish area supports wiregrass (*Spartina patens*), coco (*Scirpus robustus*), and three-cornered grass (*Scirpus olneyi*) in the area next to the salt marsh. In the transitional region between brackish and fresh water areas, transitional types occur. These include such plants as yellow cutgrass (*Zizanoipsis miliacea*), bull tongue (*Sagittaria lancifolia*), pickerelweed (*Pontederia cordata*), wild millet (*Echinochloa crusgalli*), and coffee beans (*Sesban emerus*) and (*Daubentonia longifolia*).

Fresh Marsh Areas: Behind Creole and Grand Cheniere ridges are the fresh water areas of the Prairie Marsh. On the higher ridges of this area, a mixture of plants such as bull grass (*Paspalum boscianum*), lake grass (*Paspalum distichum*), smartweed (*Polygonum punctatum*), four square rush (*Eleocharis quadrangulata*), delta duck potato (*Sagittaria platyphylla*), coffee beans, and willows occur. In the lower parts or the belly of the marsh, saw grass (*Cladium jamaicense*) is the climax type. Scattered throughout this area are old deep peat burns that form ponds. These contain waterlilies (*Castalia spp.*), crayfish moss (*Cabomba caroliniena*), coontail (*Ceratophyllum demersum*), bulrush, or saw grass depending upon how near the pond has returned to the true marsh condition.

Ecological characteristics which limit the game production potential of the marsh area are as follows:

1. Farming and forest areas are negligible and preclude the production of significant amounts of forest or farm game in these areas.

2. The vast marsh area is unique in character and is some of the best waterfowl and fur habitat in the United States. Aside from these rabbits, marsh deer and rails, are the only other game species common in the area.

FOREST GAME IN LOUISIANA
White-Tailed Deer

There are two distinct races of white-tailed deer in Louisiana. *Odocoileus virginianus louisianae* is the common upland and swamp inhabiting deer while *O. v. mcilhennyi* is a small-bodied, large-footed race occupying the coastal marshes and its fringes. (Lowery 1943).

The life cycle and general biology of the white-tailed deer in Louisiana is not startlingly different from that of this species in other parts of the United States. Occurrence of the species is primarily confined to rather densely wooded, brushy or swampy second-growth areas where there is ample food and cover. Escape cover is particularly necessary in the State since dog hunting and free ranging dogs are prevalent in Louisiana.

The average size of mature bucks taken here is approximately 100 pounds, although much larger deer are reported. Rutting occurs in November and December and the fawns are dropped the following May or June. Later rutting and fawning in areas where spring floods occur is reported. It is suggested that this condition is an adaptation by the animals in such areas that avoids fawning during the annual spring floods. At birth, the sex ratio is approximately 1 to 1, but a long standing buck law in the State has resulted in an adult ratio that ranges from 1 to 3 to as high as 1 to 8 bucks to does in some areas.

RECENT HISTORY OF DEER CONDITIONS IN LOUISIANA

As pointed out earlier in this report, an estimated 400,000 deer are believed to have once ranged in Louisiana. Although this large herd of deer was much reduced by the early settlers and by market hunting in the nineteenth century, much of it still remained as late as 1880. In 1884, deer were reported in all but 10 of the 58 parishes in existence at that time. (See table 24.) Of the ten parishes reporting no deer, four were in the coastal marsh area, two were in the prairie section where deer were never plentiful, and three were areas settled early with large urban centers and high populations. The remaining parish not reporting deer was Madison. It is believed that this is in error. By 1950, only 13 parishes were found to have no deer at all but more than 26 of the 64 parishes had less than 100 deer each. In most cases, the deer populations were not large enough to insure breeding or hunting in these parishes. Populations dense enough to afford hunting occurred in 22 parishes of the 64. (Table 24).

Although there are considerably fewer deer in the State in 1950 than in 1880, much evidence indicates that the minimum population occurred between 1915 and 1925. Since that time the deer population has been gradually increasing and a most conservative estimate would place the present population at least 30 per cent greater than in 1920. This is borne out by the fact that such areas as Tensas and Madison Parishes, now carrying nearly 25 per cent of the State's population had few or no deer around 1920.

A chronological picture of the changes in deer conditions between 1880 and 1950 may be described as follows: In 1880, much of Louisiana was still virgin wilderness and had not yet seriously felt the axe and saw of the lumber interests. Deer still ranged over most of the state being reported absent only from the prairies, near urban centers, and in certain coastal marsh areas. With the advent of the railroads and sawmills, a great change in the basic range of the deer occurred. Between 1890 and 1920, all of the choice upland pine-hardwood ranges were stripped and in many instances burned. The virgin cypress swamps were invaded and cut, and the longleaf pine

TABLE 24

OCCURRENCE OF NATIVE SPECIES BY PARISHES

1890 and 1950

Parish	Bear		Deer		Turkey		Squirrel		Rabbit		Prairie Chicken		Quail	
	1890	1950	1890	1950	1890	1950	1890	1950	1890	1950	1890	1950	1890	1950
Acadia								xx		xx	xx		xx	xx
Ascension	xx		xx	xx			xx	xx	xx	xx			xx	xx
Assumption			?	xx			xx	xx		xx			xx	xx
Avoyelles	xx		xx	xx	xx		xx	xx	xx	xx	xx		xx	xx
Bienville			xx	x	xx	x	xx	xx	xx	xx			xx	xx
Bossier			xx	x	xx		xx	xx	xx	xx			?	xx
Caddo			....	x				xx		xx			?	xx
Calcasieu			xx	x			xx	xx	xx	xx	xx		xx	xx
Caldwell			xx	x	xx	x	xx	xx	xx	xx			xx	xx
Cameron	....		....	x	....		....	xx	....	xx	xx		....	xx
Catahoula	xx		xx	xx	xx	x	xx	xx	xx	xx			xx	x
Claiborne			xx	x	xx		xx	xx	xx	xx			xx	xx
Concordia	xx		xx	xx	xx		xx	xx	xx	xx			xx	xx
De Soto	xx		xx	x	xx		xx	xx	xx	xx			xx	xx
E. Baton Rouge	....		....		....	x	....	xx	....	xx			....	xx
E. Carroll	xx	x	xx	xx	xx	x	xx	xx	xx	xx			xx	xx
E. Feliciana			....		xx		xx	xx	xx	xx			xx	xx
Franklin	xx		xx	xx	xx	x	xx	xx	xx	xx			xx	xx

TABLE 24—(Cont'd)

OCCURRENCE OF NATIVE SPECIES BY PARISHES

1890 and 1950

Parish	Bear 1890-1950		Deer 1890-1950		Turkey 1890-1950		Squirrel 1890-1950		Rabbit 1890-1950		Prairie Chicken 1890-1950		Quail 1890-1950	
Grant			xx	xx	xx		xx	xx	xx	xx			xx	xx
Iberia		x	xx				xx	xx	xx	xx	xx		xx	
Iberville			xx	xx			xx	xx	xx	xx			xx	xx
Jackson			xx	x	xx		xx	xx	xx	xx			xx	xx
Jefferson			....	?			xx	xx	xx	xx			....	xx
Lafayette	....		....		?		....	xx	....	xx	xx		xx	x
Lafourche			xx	xx			xx	xx	xx	xx				xx
Livingston	....		....	xx	....	xx	....	xx	....	xx			....	xx
Lincoln			xx	x	xx		xx	xx	xx	xx			xx	xx
Madison	xx	x	-?	xx	xx	xx	xx	xx	xx	xx			xx	xx
Morehouse			xx	xx	xx	xx	xx	xx	xx	xx			xx	xx
Natchitoches			xx	xx	xx	x	xx	xx	xx	xx			xx	xx
Orleans			....				?	xx		xx			....	x
Ouachita			xx	x	xx		xx	xx	xx	xx			xx	xx
Plaquemines	....		....	?	....		....	xx	....	xx	....		....	x
Pointe Coupee	xx		xx	xx	xx		xx	xx	xx	xx			xx	xx
Rapides			xx	x	xx	x	xx	xx	xx	xx			xx	xx
Red River			xx	x	xx	x	xx	xx	xx	xx			xx	xx
Richland	xx		xx	x	xx		xx	xx	xx	xx			xx	xx
Sabine			xx	x	xx			xx	xx	xx			xx	xx
St. Bernard			xx	x			xx	xx	xx	xx			....	x
St. Charles			xx	x			xx	xx	xx	xx			....	xx
St. Helena			xx	x	xx	xx	xx	xx	xx	xx			xx	xx
St. James	x		x	xx			xx	xx	xx	xx			....	xx
St. John	x		x	xx			xx	xx	xx	xx			....	xx
St. Landry			xx	xx	xx		xx	xx	xx	xx	xx		xx	xx
St. Martin	xx		xx	xx	xx		xx	xx	xx	xx	xx		xx	xx
St. Mary		x	xx	xx			xx	xx	xx	xx	xx		xx	xx
Tangipahoa			xx	xx	xx		xx	xx	xx	xx			xx	xx
Tensas	xx	x	xx	xx	xx	xx	xx	xx	xx	xx			xx	xx
Terrebonne	xx		xx	xx			xx	xx	....	xx	....		....	x
Union		x	xx	x	xx	x	xx	xx	xx	xx			xx	xx
Vermilion			xx	xx			....	xx	....	xx	xx		xx	x
Vernon			xx	x	xx		xx	xx	xx	xx	xx		xx	xx
Washington			xx	x	xx	xx	xx	xx	xx	xx			xx	xx
Webster			xx	x	xx		xx	xx	xx	xx			xx	xx
W. Baton Rouge	xx		xx	x	xx		xx	xx		xx			xx	xx
W. Carroll	xx		xx	x	xx		xx	xx	xx	xx			....	xx
W. Feliciana			xx		xx		xx	xx	xx	xx			xx	xx
Winn			xx	xx	xx		xx	xx	xx	xx			xx	xx
Total Parishes	16	6	46	49	36	16	48	58	46	58	12		43	58

? Of questionable occurrence.
x Present—too sparse to hunt.
xx Present in number large enough to afford hunting.
... No report.
Blank Absent or reported absent.

lands were left a denuded barren. This process of stripping the range of timber forced the deer to seek out a much decreased range area in the small branch bottoms and in fringing sub-marginal timber areas. Under such conditions, they were at the mercy of man and dog during an era of too liberal or unenforced bag limits, hunting laws, and conservation measures. This continued until their numbers became dangerously low and conservation laws had to be enacted.

A few deer managed to survive in the most inaccessible swamp and backwoods areas. From this nucleus, the present population has resulted. The vast tangles of second-growth brush and scrub type trees that filled in much of the cut-over areas offered a better range than the original. This resulted in an increase in population despite continued hunting pressure, but a shift in deer distribution has occurred. Although populations have increased markedly, deer have not repopulated the pine-hardwoods ranges to any great extent because there is a lack of thick cover or any areas where they can escape from dogs or hunters. Since this is the case, hunting pressure has prevented the repopulation of this type range. On the other hand, the swamp and bottomland hardwood areas now carry a much higher population than did such ranges under virgin conditions.

GENERAL DEER CONDITIONS IN LOUISIANA

Total Population and Annual Kill

At the completion of this inventory, Louisiana had a deer population of approximately 67,000 white-tailed deer. Forty-four thousand of these deer occupy the swamp and uplands of Louisiana and some 22,500 of the race *O. v. mcilhennyi* are in the coastal marshes. With a total population of more than 67,000, Louisiana ranks among the first in the Southern States and around seventeenth in the nation in deer population. Because of inaccessibility of the area and difficulty of terrain, however, an estimated 10,000 to 15,000 deer in the coastal marshes are unhuntable to the average sportsman. This means that the bulk of Louisiana's deer kill is taken from the 40,000 to 50,000 deer in the uplands, swamps, and along the edges of the coastal marsh.

The annual deer kill in Louisiana is between 10 per cent and 12 per cent of the huntable population or some 4,500 to 5,000. This figure is based on actual bag checks over large areas and a study of hunting camp records. A rather complete analysis of the kill and population was made in the Blind River-Lake Maurepas area, including parts of Ascension, Livingston, Tangipahoa, St. James, and St. John Parishes. This area of approximately 200 square miles is a typical cut-over cypress-tupelo swamp and represents some of the most densely populated deer range in the State. (See Table 25 and deer map—Fig. 6). Fortunately, it has been subjected to semi-regulated hunting by the Lutcher-Moore Lumber Company for the past twenty years.

The general procedure has been to set aside some 30 square miles as a refuge in the center of the swamp and to issue club permits to hunt certain prescribed areas around the refuge.

A list of all hunting groups, the areas allotted them, and the number of hunts for each was made available for this investigation. As a result of this, an unusually accurate picture of typical deer hunting success in some of the State's best deer range was obtained. Table 25 summarizes the findings from the Blind River-Maurepas Swamp.

An examination of the above table will show specific figures in each instance. In all cases, they represent the absolute minimum and are presented exactly as obtained from the field notes.

Certain of these figures as obtained do not, however, represent what is considered to be the true condition in the area. For example, the 310 hunters is not a true figure of the total number of men enjoying deer hunting in this area, but rather represents the maximum number hunting in the area at one time. Permits are issued to club captains who are supposed to select any twelve men. This

TABLE 25

HUNTING CLUB DEER KILL DATA

BLIND RIVER-LAKE MAUREPAS AREA

Club No.	No. of Members	Size of areas hunted in sq. miles	No. hunts per season	No. Deer killed per season	Avg. kill per hunt	Avg. Annual kill
1	20	8	10	35	3.5	20.35
2	10	5	2	2	1.0	10-12
3	12	5	7	18	2.5	30
4	12	6	12	....	....	....
5	12	7	7	7	1.0	20
6	12	5	7	....	....	....
7	14	6	....	....	....	....
8	12	1	10	15	1.5	16
9	12	5	5	5	1.0	

TABLE 25—(Cont'd)

HUNTING CLUB DEER KILL DATA

BLIND RIVER-LAKE MAUREPAS AREA

Club No.	No. of Members	Size of areas hunted in sq. miles	No. hunts per season	No. Deer killed per season	Avg. kill per hunt	Avg. Annual kill
10	8	3	10	12	1.2	15
11	12	6	7	14	2.0	15
12	12	6	....	....	....	....
13	8	5	5	4	0.8	8
14	12	7	3	8	2.7	14
15	12	5	....	....	....	....
16	12	4	....	....	....	....
17	9	5	3	6	2.0	8
18	14	11	12	17	1.4	26
19	12	5	....	....	....	....
20	12	4	3	2	0.7	3
21	8	7	1	4	4.0	4
22	12	5	10	15	1.5	15
23	10	4	10	33	3.3	30
24	15	2	8	22	2.8	25
25	18	6	8	17	2.1	20
26	10	4	10	25	2.5	25
27	10	5	10	25	2.5	25
	322	142	160	286	1.8	346
Avg.	11.9	5.25	7.3	14.3	1.8	18.2
Adjusted* Total	322	142	196	386		491

Deer kill per sq. mi. per season 1945	2.72
Deer kill per sq. mi. per season—15 yr. period	3.46
Man days hunted annually	1944
Man days hunted per deer killed	6.8

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*Adjusted to compensate for clubs not interviewed. Average condition allowed for missing information.

number is exceeded to some extent, however, since such a method allows for different men to hunt on a permit and makes the total number of different hunters using the swamp perhaps as much as 500 or 1,000. The deer kill of 1945 fixed at 386, based on reports from all clubs, is an absolute minimum. There is evidence that several clubs killed over the limit and certain of the clubs reporting low kills, apparently withheld information because of illegal doe kills. An estimate of the total kill including illegal doe, fawn, and night kills would not be excessive at 450 or 500 deer per season. This is particularly true of the yearly average for a number of years back because enforcement was lax and many deer were slaughtered during high water periods and at night. During the late nineteen twenties and nineteen thirties, all evidence points to as great an illegal kill as a legal one.

The average annual kill of from 450 to 500 deer determined for the Blind River Swamp Area was made from a total herd of some 5,000. From this rather detailed study plus checks in the Tensas-Madison Parish area, it is reasonably clear that approximately 10 per cent of the population is killed by hunters in the primary bottomland deer ranges in the State each season. Some evidence indicates that the per cent kill in the pine-hardwoods areas is somewhat higher. Since this study was completed, Lauckhart (1950) has found that a 10 per cent kill is approximately the average.

RANGE AREA AND POPULATION DISTRIBUTION

There are approximately 8,400,000 acres of occupied and potential but unoccupied deer range in Louisiana's swamps and uplands. (See Tables 26 and 27 and Map, Fig. 6). In addition to this, there are nearly 4,000,000 acres of marsh containing some 15,000 deer which cannot be successfully hunted. Since these marsh lands are not readily huntable and since this area, in general, would be the last to be managed for deer in the State, the marsh should be considered as separate from the primary deer range of the State. In general, there is little that can be said for deer conditions on the coast. Presumably, the populations are near the maximum and the annual kill is negligible. Potentially, this area has little to offer in the way of deer hunting or increased populations, but it should furnish a source of deer for stocking other areas if an economical and successful means to trap them can be devised.

For all practical purposes the 45,000 or more deer distributed over 8,400,000 acres of swamps and uplands represent the total huntable and manageable deer population in Louisiana. An analysis of this segment of the deer population brings to light some basically important facts that should serve as a key to the management of deer in the uplands of Louisiana. The first fact made clear by this analysis is that the present upland deer population is primarily confined to the bottomland hardwoods and cypress-tupelo swamp areas of the State. (Compare deer map (Fig. 6) and forest type map Fig. 12.) In these alluvial areas of the various river bottomlands consisting of 26 of the State's 64 parishes, the deer range and population is distributed as follows:

TABLE 26
SUMMARY OF GENERAL DEER DATA IN BOTTOMLANDS

Occupied Range	3,424,920 Acres
Unoccupied Range	589,200 Acres
Total Range	4,014,120 Acres
Total Population	41,764 Acres
Per cent of upland population	94.2%
Avg. population density	1 dear in 82.0 acres

It is clear from the above figure that although the bottomland areas consist of only half of the total upland range of the State, it carries 94.2 per cent of all the deer outside the marsh. A still closer examination of deer conditions in this area indicates that within it there are areas with much higher deer populations than others. For example, there are 22,090 deer or 49.8 per cent of all the State's upland deer population occupying only 911,000 acres of range in all or parts of only seven parishes within this bottomland type deer range. (See deer map Fig. 6 and Table 31.)

The remaining half of the State's deer range is either unoccupied or very sparsely occupied by deer. A comparison of maps (Figs. 6 and 12) will show that most of the unoccupied deer range is in the pine and pine-hardwoods areas of the north, western, west central, and southeastern parts of the State. A summary of the conditions in this pine-hardwoods type range is as follows:

TABLE 27
A SUMMARY OF GENERAL DEER DATA IN THE PINE-HARDWOODS AREAS

Range very sparsely occupied or recently restocked	1,344,000 Acres
Potential range unoccupied	2,899,009 Acres
Total undeveloped range in State	4,243,009 Acres
Total deer population	2,563
Per cent of State's deer population	5.8 %
Population density over entire area	1 deer in 1655 Acres
Population density on occupied range	1 deer in 524 Acres

The above summary of data on deer conditions in the pine-hardwoods areas should be compared with those for the primary occupied deer range in the bottomland sections. (See Table 26).

Study of the deer map (Fig. 6) indicates one other area besides the marsh that has not been considered. This is the southwest Louisiana prairie lands and rice producing area of the State. It consists of all or parts of six parishes, but because of the prairie type vegetation in the area contains only 188,000 acres of wooded areas that might be used for deer. The distribution of the forested areas here are such that they offer little in the way of potential deer range.

With the general picture of deer conditions in Louisiana in mind, attention may now be focused on the detail of conditions controlling deer populations and trends in the various ecological regions of the State. Each region, except the bottomland areas, will be discussed separately.

DEER IN THE UPPER MISSISSIPPI-TENSAS AND LOWER MISSISSIPPI-ATCHAFALAYA BOTTOMLAND

These two sections of the Mississippi River flood plain are discussed together because the vast deer ranges in them are similar and contiguous and because, for management purposes, they are alike for this species.

Range

The deer range in this alluvial plain consists of over 4,000,000 acres or 51.2 per cent of the total area. It is primarily a vast bottomland hardwood forest. The details of forest types, forest make-up, and plant species have been discussed earlier in the report. In the southern section, cut-over cypress-tupelo swamps, mixed hardwoods on ridges in the swamp, and the wetter land type hardwoods make up the basic range. In the northern half of the range higher land and somewhat better drainage result in mixed bottomland types making up most of the range. Tables 28 and 29 give a breakdown of the deer range by parishes, type, and whether occupied or unoccupied. The deer map (Fig. 6) illustrates the general location of these deer areas.

A study of the data listed in the tables indicates that the majority of the range is occupied and only a relatively small portion is unoccupied. One reason for this is that practically all major forest areas from the Arkansas line to the Coastal marshes are contiguous. This results in large blocks of forest covering parts of several parishes and allows for parishes with small forest acreages to have high deer populations. The reason for this is that the forested areas from several parishes join and form a unit large enough to support and protect sizable deer populations. In all cases where parishes have low populations it is because the limited range in them is isolated, preventing natural restocking or an escape route to larger areas. In some areas with sizable forest acreage there are no deer because of the peculiar distribution of forest; for example, there may be long narrow strips of forest along streams or a forest excessively interspersed with farms; neither of these types furnishes suitable range.

FOOD CONDITIONS ON RANGE

If historic references are accurate, the deer population existing in the bottomland of the Mississippi River and its associate streams, is much greater now than in the original condition. The reason for this is apparently due solely to a change in food conditions. Originally, the canopy formed by the mature hardwoods was so thick that little grew in the understory excepting dense canebrakes and palmetto in the less flooded areas. Cypress-tupelo areas in the south were constantly under water and to great depths with the annual spring floods. Such conditions were not conducive to large game populations and early writers reported only bear prevalent in the cane brakes along the Mississippi. After the forests were cut and the flooding controlled by levees, a brushy, dense second-growth forest sprang up and resulted in a vastly improved deer range both from a food and cover standpoint.

Generally, in a large scale survey, there is little time for detailed work on the use of various plant species by deer. Fortunately, however, recent research by Bateman (1949) on the usage and palatability of various Louisiana plant species by deer was available as a reference for this work. Bateman working on deer browse and on feeding penned deer in the Southeast Louisiana Terrace area has tested numerous plants. The species tested are all common to the terrace and pine hill lands but many of them are also common to the bottomland areas. Since Bateman's work is presented in far greater detail and under controlled conditions, liberal reference is made to his findings in reporting on deer food conditions throughout this report.

Table 30 lists the plant species suitable for deer food in the bottomland areas of the State.

In the above table, the plant species most palatable to deer and those readily used are so marked. Work similar to Bateman's is needed in the bottomlands and particularly on the cypress-tupelo swamp plant species to determine the usage of many species not tested by him.

It is obvious, from studies by Bateman (1949) and from field observations on this project, that deer food is plentiful and varied throughout the State and that the food supply in the bottomland areas is excellent. No shortage of food was evident during any part of the year; during winter the deer are more dependent on the evergreens such as smilax, yaupon, and mast. Louisiana's short winters and lack of snows preclude any great dearth of deer foods until the populations reach the proportion of 1 deer to 15 or 20 acres.

Population Density and the Distribution of Deer in the Bottomlands

As pointed out above, 94.2 per cent of Louisiana's upland deer are in the alluvial bottomlands of the Mississippi and Atchafalaya River systems. This area includes some 3,424,920 acres in all or parts of 27 parishes. Tables 28 and 29 list the breakdown of deer populations, population density, annual kill, and potential populations by parishes. The deer map (Fig. 6) shows the areas involved.

A closer examination of Tables 28 and 29 will show that even in this heavily populated deer range, some areas are much more productive than others. Table 31 lists all or parts of eight parishes that have a combined deer population equal to that of the remainder of the State excluding the marsh. (See map–Fig. 6). The facts that 41,794 or 94.2 per cent of all the upland deer in the State are confined to 40 per cent of the State's deer range and that 49.8 per cent of all deer are on only 10.6 per cent of the State's total range are the most significant findings about this species. It is immediately obvious that there must be some reason for such a disproportionate distribution of deer. To understand fully the cause of this peculiar distribution of deer, the changes in land use and hunting pressure for the past 50 years must be reviewed.

Before the virgin timber of the State was cut between 1880 and 1920, deer were scattered over the entire State. As the pine lands and bottomlands were cut clean and burned, the total deer range was reduced by more than half. This, coupled with relentless hunting and chasing by dogs, eliminated the deer from the pine-hardwoods areas and all but eliminated them in the swamps.

TABLE 28

SUMMARY OF DEER INVENTORY

LOWER MISSISSIPPI-ATCHAFALAYA BOTTOMLANDS

PARISH	Type & Size of Occupied Range		Type & Size of Unoccupied Pontential Range		Estimated Present Population	Average Population Density On Occupied Range	Annual Kill	Estimated Potential Population
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods				
Ascension	37,120[1]		10,000[1]		1,480	25[2]	140	1,700
Assumption	114,000				570	200	55	2,280
Avoyelles	259,000				1,295	200	100	5,180
Iberia	130,000				1,500	200	150	2,600
Iberville	244,000				1,220	200	140	4,880
Lafourche	151,000				755	200	75	3,020
Livingston*	32,000		112,000		1.000	32	100	4,500
Pointe Coupee	172,000				860	200	80	3,440
St. James	100,000				3,000	33	300	4,000
St. John	78,000				2,430	32	240	3,000
St. Landry	225,000				1,275	200	120	5,100
St. Martin	317,000				1,585	200	150	6,340
St. Mary	52,000				260	200	20	1,040
Tangipahoa*	48,000		10,000		1,500	32	150	3,000
W. Baton Rouge	50,000				150	330	25	1,000
TOTAL	2,009,120		132,000		18,880	106	1,845	51,080

[1] Acres

[2] Acres per deer

* Includes only bottomland sections of these parishes.

TABLE 29

SUMMARY OF DEER INVENTORY

UPPER MISSISSIPPI-TENSAS BOTTOMLANDS

PARISH	Type & Size of Occupied Range		Type & Size of Unoccupied Pontential Range		Estimated Present Population	Average Population Density On Occupied Range	Annual Kill	Estimated Potential Population
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods				
Caldwell**	12,800[1]		57,200[1]		94*	606[2]	Season Closed	1,500
Catahoula**	75,000				250	300	25	1,500
Concordia	300,000				6,000	50	500	6,000
East Carroll	81,000				800	101	75	1,600
Franklin	45,000		25,000		400	112	35	1,400
Madison	200,000		50,000		5,000	40	350	6,000
Morehouse	239,000				1,150	207	35	4,700
Ouachita**	16,000		135,000		40	400	Season Closed	3,000
Rapides**	40,000		190,000		100	400	Season Closed	4,600
Richland	50,000				35	1,428	Season Closed	1,000
Tensas	271,000				9,000	30	900	10,000
West Carroll	86,000				15	5,733	Season Closed	1,700
TOTAL	1,415,800		457,200		22,884	62	1,920	43,000
Total Entire River Bottomlands from Tables 28 and 29	3,424,920		589,200		41,764	82	3,765	94,080

* Includes recently stocked animals.

[1] Acres

[2] Acres per deer

** Pine hardwoods sections of these parishes in Tables 34 and 36.

TABLE 30

PLANTS UTILIZED BY DEER

ALLUVIAL BOTTOMLANDS

CYPRESS-TUPELO AREAS AND WET BOTTOMLAND AREAS	MIXED BOTTOMLAND HARDWOODS AREAS ON BETTER DRAINED SOILS
Woody Sprouts and Young Trees	
Cypress (_Taxodium distichum_)*	Cypress (_Taxodium distichum_)*
Tupelogum (_Nyssa aquatica_)[1]	Shumard red oak (_Quercus shumardii_)[1]
Redgum (_Liquidambar styraciflua_)	Redgum (_Liquidambar styraciflua_)*
Water oak (_Quercus nigra_)*	Water oak (_Quercus nigra_)*
Live oak (_Q. virginiana_)*	Live oak (_Q. virginiana_)*
Willow oak (_Q. phellos_)[1]	Willow oak (_Q. phellos_)[1]
Overcup oak (_Q. lyrata_)[1]	Overcup oak (_Q. lyrata_)[1]
Bitter pecan (_Carya aquatica_)*	Bitter pecan (_Carya aquatica_)*
Green ash (_Fraxinus pennsylvanica_)*	Green ash (_Fraxinus pennsylvanica_)*
Waterlocust (_Gleditsia aquatica_)*	Waterlocust (_Gleditsia aquatica_)*
	Elm (_Ulmus americana_)*
	Cottonwood (_Populus deltoides_)*
	Persimmon (_Diospyros virginiana_)*
Smaller Trees and Shrubs	
Drummond red maple (_Acer drummondii_)*	Swamp privet (_Forestiera acuminata_)[1]
Waterelm (_Planera aquatica_)*	Palmetto (_Sabal minor_)[1]
Pumpkin ash (_Fraxinus tomentosa_)*	Sumac (_Rhus_ spp.)*
Buttonbush (_Cephalanthus occidentalis_)*	Drummond red maple (_Acer drummondii_)*
Snowbell (_Styrax americana var pulverulenta_)?	Buttonbush (_Cephalanthus occidentalis_)*
Mulberry, red (_Morus rubra_)**	French-Mulberry (_Callicarpa americana_)**
French-Mulberry (_Callicarpa americana_)**	Dogwood, roughleaf (_Cornus drummondii_)**
Sassafras (_Sassafras albidum_)**	Hawthorn (_Crataegus spp._)?
Virginiawillow (_Itea virginica_)?	Holly (_Ilex spp._)**
Waxmyrtle (_Myrica cerifera_)*	Elderberry (_Sambucus canadensis_)*
Elderberry (_Sambucus canadensis_)*	Swamp privet (_Forestiera acuminata_)[1]
Prickly-ash (_Zanthoxylum clava-herculis_)**	Palmetto (_Sabal minor_)[1]
	Sumac (_Rhus spp._)*
Forbs	
Wild grape (_Vitis spp._)**	Wild grape (_Vitis spp._)**
Blackberry (_Rubus spp._)*	Blackberry (_Rubus spp._)*
Beggarweed (_Meibomia spp._)**	Switch cane (_Arundinaria tecta_)?
Switch cane (_Arundinaria tecta_)?	Smilax (_Smilax spp._)**
Smilax (_Smilax spp._)**	Rattan vine (_Berchemia spp._)**
Rattan vine (_Berchemia spp._)**	
Alligator weed (_Alternanthera philoxeroides_)[11]	

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* Reported eaten by deer, Bateman (1949).

** Reported very palatable to deer by Bateman.

[1] Reported eaten, from field observations, not tested.

[11] Reported very palatable from field observation.

? Usage by deer not determined in this work.

Some deer were able to survive in the deeper more inaccessible swamps because they could escape from man and dogs. From this stock, the deer herds of the swamp and bottomlands have been able to re-establish themselves, but the deer have not been able to re-enter the reforested pine lands because in such relatively open woods they cannot escape from dogs and either they are easily killed or chased back into the tangles of the swamp. This has been borne out over a 25-year period as deer have failed to move from the thickly populated Blind River area of Livingston Parish into an adjacent and excellent pine-hardwoods range.

Even in Louisiana's swamp areas, the harassment of deer by dog hunting and excessive kills have taken their toll. There is ample evidence for this in the fact that 50 per cent of the deer are concentrated in eight parishes on 911,000 acres that have some type of refuge or protective system in or near them. In these protected areas, the population density is double that in the unprotected parts of the swamp and bottomland area. It is also evident that this population increase in protected areas is not due to less kill. A comparison of Tables 28, 29, and 31 indicates that more than three times as many deer are killed in the parishes with refuges than in those without protection. It is clear from above evidence that the only deer ranges in the State producing anywhere near their maximum are the areas where some type of protection, either artificial or natural, has been offered the deer from illegal hunting, running by dogs the year round, and a chance to escape and rest during the hunting season.

Limiting Factors in the Bottomland Areas:

There are four basic limiting factors to rapidly increasing deer herds in the bottomland areas. These are illegal hunting, excessive legal hunting with dogs, floods, and competition for food from free-ranging livestock.

Although illegal hunting is under much better control than in former years, it still takes a toll of doe deer during regular season and of all types of deer from night hunting, out-of-season hunting, and exceeding the legal limit. Probably the greatest damage is done during times of flood when deer are forced out of the swamps or upon ridges where they become easily accessible. Illegal kills and heavy legal kills probably do much to keep deer from spreading from the fringes of the main population and such pressure definitely prevents small isolated herds from growing as they should.

Periodic flooding of a large per cent of the bottomland deer range occurs. (See map, Fig. 5.) At such times, a definite loss of animals occurs from drowning, loss of fawns, and illegal kills. (See Plate 4.) Considerable study should be applied to the effect of flooding on deer populations in Louisiana. At this time, it is not known whether the ranges subject to flooding can carry more deer than they do at present.

Competition from free ranging livestock can, no doubt, be serious. Just how seriously this affects the deer in the bottomlands is not known. Bateman (1949) finds that cattle eat the more desirable deer browse plants in winter when they are, of course, most needed by the deer. He points out that deer do well on such browse while the nutritive value to cattle is questionable since it is a minor supplement to their complete diet. Since this is true, it seems unwise to run cattle on deer range, especially during winter months. The effect of free-ranging hogs is obvious in that they compete directly for the all-important acorn crop. In some areas, it is doubtful if deer ever get a significant portion of the mast because the hogs are so numerous. During a recent flood, over 40,000 hogs were reported to have been driven from a range where they coexisted with some 6,000 deer. Elimination or reduction of some of these limiting factors should materially increase the deer herds in the area.

Deer Potential of the Bottomlands and Recommendations

The deer potential of the alluvial bottomlands is at least 90,000 to 100,000 or roughly double the present population. (See Tables 28 and 29). This estimated potential is based on the fact that the best areas can sustain at least 1 deer in 40 acres and probably more as indicated in Table 31. Actually, many more deer could probably be placed on this type range before serious browse depletion occurs. On the other hand, it should not be assumed that the carrying capacity of Louisiana ranges cannot be reached. As has happened in other states, over-populations could occur here and will if the herds are not controlled in years to come. Bateman (1949) has found serious deer browse depletion in a private park with a herd density of 1 deer to 20 acres. Personnel on other Pittman-Robertson projects have found similar

TABLE 31

SUMMARY OF DEER INVENTORY

PARISHES WITH REFUGES

PARISH	TYPE & SIZE OF OCCUPIED RANGE		TYPE & SIZE OF UNOCCUPIED POTENTIAL RANGE		Estimated Present Population	Average Population Density on Occupied Range	Annual Kill	Estimated Potential Population
	Swamp and bottomland hardwoods	Pine - hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwood and upland hardwoods				
ASCENSION	37,120[1]		10,000[1]		1,480	25[2]	140	1,700
LIVINGSTON	32,000		112,000		1,000	321	100	4,500
MADISON	200,000		50,000		5,000	40	350*	6,000
MOREHOUSE	239,000				1,150	207	35	4,700
ST. JAMES	36,500				1,460	25	150	1,500
ST. JOHN	48,000				1,500	32	150	1,500
TANGIPAHOA	48,000		10,000		1,500	32	150	1,950
TENSAS	271,000				9,000	30	900	10,000
TOTAL OR AVERAGE	911,620		182,000		22,090	41	1,975	31,850

* Restricted season here prevents taking expected 10% kill.

[1] Acres.

[2] Acres per deer.

and more extreme browse damage in other enclosures. Deer population in the Tensas-Madison area should be carefully investigated. Populations are known to be high there and no doubt are rapidly approaching the maximum. Key food types may have already been consumed on this range, but such cannot be determined without further study.

In order to attain the maximum deer populations in the bottomland ranges, the following steps are recommended:

1. Restock potential ranges after careful surveys to determine feasibility of such stocking. All possible measures should be taken to prevent illegal kills and to protect these new herds from harassment by feral dogs.
2. Establish a system of tagging all deer killed and licensing deer hunters separately. This would give a greater control of the deer kill, clearly define the segment of hunters that are deer hunters, and should reduce the number of illegal kills in the form of exceeded bag and season limits.
3. Maintain an annual check on food conditions in all areas so that over-population may be anticipated in time to lengthen season, increase bag limits, and open the season on does. This is vital to prevent starvation and crop damage.
4. Discourage the use of dogs in those areas where the forest is not dense enough to afford good escape cover.
5. Study the buck: doe ratio, the effects of over-population on deer range and the economic aspects of over population in relation to commercial timber and agricultural crops. Some deer from over-crowded herds may be used as a valuable source of trapped deer to stock unpopulated ranges.
6. Follow the development of herds in each area with a sound harvest program designed to assure maximum long range benefits. Such a program would prevent serious range damage with its accompanying lowered carrying capacity, and would, in time, require that the harvest be directed at both sexes.

These recommendations are broad and basic. Many of them are now being applied throughout the State. In some cases, special attention may have to be given specific areas.

DEER IN THE SOUTHEAST LOUISIANA TERRACE LANDS

The Southeast Louisiana Terrace Lands consist of eight parishes commonly known as the "Florida Parishes". In general, this ecological division contains pine, pine-hardwoods, and mixed terrace land hardwoods on its deer range. (See pages 79 to 84) The southern parts of two parishes, Livingston and Tangipahoa, contain considerable amounts of cypress-tupelo swamps. The swampy part of this ecological division and its deer have been included in and discussed with the bottomland sections. For the purposes of this report, only the pine-hardwoods and mixed hardwood areas of the Florida Parishes are considered as making up the ecological division being discussed here.

RANGE

The present occupied deer range in this area is highly restricted; it is confined to the mixed hardwood areas along the Pearl River and to small isolated spots in Livingston and St. Helena Parishes. The total acreage of occupied range is 145,000; over 100,000 acres of this is in the poorly populated Pearl River bottom. (See Table 32.) For all practical purposes, the entire deer range in this area should be considered as potential range either unoccupied or sparsely occupied. A study of Table 32 shows a total of 639,080 acres of deer range. This is only 22.3 per cent of the total area and normally might be considered somewhat limited if the forest were scattered over the entire area. Fortunately, most of the occupied and potential range is concentrated into two areas which adds up to considerable blocks. These two areas are the mixed bottomland hardwoods along the Bogue Chitto and Pearl Rivers in Washington and St. Tammany Parishes and a vast block of pine-hardwoods centered in Livingston and St. Helena Parishes. These two areas are considered here as the primary ranges in the area and the places where management should start. The deer map (Fig. 14) indicates the areas where forests are of sufficient size and density to constitute good deer range. This potential deer range may be compared with the forest types of the area for a clearer picture of the range make-up. (See maps Figs. 6 & 12)

FOOD CONDITIONS ON RANGE

A detailed study of the use of various plants in this area by deer and on the carrying capacity of certain parts of the forest has

TABLE 32

SUMMARY OF DEER INVENTORY

S. E. LOUISIANA TERRACE LANDS (FLORIDA PARISHES)

PARISH	TYPE & SIZE OF OCCUPIED RANGE		TYPE & SIZE OF UNOCCUPIED POTENTIAL RANGE		ESTIMATED PRESENT POPULATION	AVERAGE POPULATION DENSITY ON OCCUPIED RANGE	ANNUAL KILL	ESTIMATED POTENTIAL POPULATION
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods				
E. BATON ROUGE			16,000[1]				Season closed	300
E. FELICIANA			25,000				Season closed	500
LIVINGSTON**	5,000[1]		25,000	185,000[1]	54*			4,300
ST. HELENA	10,000		25,000	60,000	10	1,000[2]		1,900
ST. TAMMANY	105,000				150	700	23	2,000
TANGIPAHOA***			10,000	30,000				1,000
WASHINGTON	25,000		23,040	55,040	25	1,000	Season closed	2,000
W. FELICIANA			40,000				Season closed	1,000
TOTAL OR AVERAGE	145,000		164,040	330,040	239	606	23	13,000

* Including recently released animals.

** Bottomland parts of these parishes in Table 28.

[1] Acres.

[2] Acres per deer.

been made by Bateman (1949). His work offers the latest and best available information on deer food conditions in pine-hardwoods and in mixed bottomland hardwood types found on bluff and terrace soils. Following is a table taken from his studies which indicates the various plants used by deer and the palatability of these plants at various times of the year. It should be noted that certain types are much preferred and will be the first browsed out as a deer population becomes high.

It is obvious from Bateman's findings (Table 33), which are fully substantiated by field observations on this project, that the available deer foods in second-growth mixed pine-hardwoods areas and their associated creek and terrace land mixed hardwoods are some of the best in the State. A wide variety of foods used by deer is found in all such areas in the State and many of the species are evergreen and especially suitable as winter browse. In final analysis, all evidence points to the fact that as far as food is concerned such areas should produce and hold high deer populations. It should be noted that Bateman's work was confined to penned deer.

Population Density and Distribution of Deer in the Southeast Terrace Lands:

The total deer population in this ecological division is slightly over 200 including recently restocked animals. Table 32 lists the numbers and the location of the various herds in the area. It is evident that, excepting in the Pearl River area (St. Tammany Parish) and in Livingston Parish, the deer population is nearing a critically low point. In Livingston parish, most of the deer are confined to a refuge in the south central part of the parish. The 150 deer in St. Tammany and 25 in Washington are scattered along the bottomlands of Bogue Chitto and Pearl Rivers—the one place in this entire area where there is some escape from dogs and dog hunting.

Limiting Factors in the Southeast Terrace Land:

The primary limiting factors in this area are illegal kills and year-round harrassment by dogs. The present low deer population in Livingston Parish is of importance because it illustrates the basic limiting factors that must be overcome for successful deer management in the pine-hardwood regions of the State. The forest type map (Fig. 12) shows the lower tip of Livingston Parish to be a cypress-tupelo swamp. This part of the parish is a well-stocked deer

TABLE 33

RELATIVE PALATABILITY[*] OF NATIVE SOUTHEASTERN TERRACE LAND VEGETATION TO DEER AS DETERMINED BY BATEMAN (1949)

Species	Dec. Jan. Feb.	March April May	June July Aug.	Sept. Oct. Nov.
Alder *(Alnus rugosa)*	O	L	O	O
Ash *(Fraxinus spp.)*	O	L	M	L
Bay, sweet *(Magnolia virginiana)*	H	L	M	M
Beech *(Fagus grandifolia)*	O	H	M	M
Blackhaw *(Viburnum rufidulum)*	O	H	H	M
Buttonbush *(Cephalanthus occidentalis)*	O	M	M	L
Birch *(Betula nigra)*	O	M	R	O
Buckeye *(Aesculus pavia)*	O	L	R	O
Catalpa *(Catalpa bignonioides)*	O	M	M	M
Cedar *(Juniperus virginiana)*	R	R	R	R
Cherry, black *(Prunus serotina)*	H	M	M	M
Chinatree *(Nelia azedarach)*	M	M	M	M
Chinquapin *(Castanea pumila)*	O	M	L	L
Cottonwood *(Populus deltoides)*	O	O	M	O
Crabapple *(Malus spp.)*	O	H	H	O
Crapemyrtle *(Lagerstroemia idica)*	O	M	M	M
Cypress, bald *(Taxodium distichum)*	O	M	O	O
Dogwood, flowering *(Cornus florida)*	O	H	M	M
Dogwood, roughleaf *(Cornus asperifolia)*	O	O	H	H
Elderberry *(Sambucus canadensis)*	O	M	M	L
Elm *(Elmus spp.)*	O	H	M	M
Gum, black *(Nyssa sylvatica)*	O	H	M	M
Gum, red *(Liquidambar styraciflua)*	O	M	L	M
Hickory *(Carya spp.)*	O	M	M	O
Holly, American *(Ilex opaca)*	L	L	O	O
Possumhaw *(Ilex decidua)*	H	H	H	H
Hornbeam *(Carpinus caroliniana)*	O	H	M	O
Hophornbeam *(Ostrya virginiana)*	O	M	L	L
Huckleberry, summer *(Gaylussacia spp.)*	H	H	M	M
Huckleberry, winter *(Vaccinium arboreum)*	M	H	R	M
Linden *(Tilia americana)*	O	H	M	O
Locust, honey *(Gleditsia triacanthos)*	O	H	H	M
Magnolia, American *(Magnolia grandiflora)*	H	M	L	L
Maple, red *(Acer rubrum)*	O	M	M	M
Mimosa *(Albizzia julibrissin)*	O	H	H	H
Mulberry, red *(Morus rubra)*	O	H	H	H
Mulberry, French *(Callicarpa americana)*	O	H	M	H
Oak, red & black *(Quercus spp.)*	O	M	L	L
Oak, water *(Quercus nigra)*	M	M	M	M
Oak, white *(Quercus alba)*	O	M	L	L
Osage-orange *(Malcura pomifera)*	O	H	H	H
Pecan *(Carya pecan)*	O	L	L	L
Persimmon *(Diospyros virginiana)*	O	M	L	L
Pine, loblolly *(Pinus taeda)*	R	R	R	R
Pine, shortleaf *(Pinus echinata)*	R	R	R	L
Pine, spruce *(Pinus glabra)*	L	R	R	R
Plum *(Prunus spp.)*	O	H	H	M
Poplar, yellow *(Liriodendron tulipifera)*	O	H	M	M
Prickly ash *(Xanthoxylum clava-herculis)*	O	H	H	H
Redbud *(Cercis canadensis)*	O	O	M	O
Sassafras *(Sassafras albidum)*	O	H	H	M
Serviceberry *(Amelanchier canandensis)*	O	M	L	O
Silverbell *(Halesia diptera)*	O	M	L	L

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[*] Palatability: H-high, M-medium, L-low, R-refused, O-not fed.

TABLE 33—(Cont'd)

RELATIVE PALATABILITY* OF NATIVE SOUTHEASTERN TERRACE LAND VEGETATION TO DEER AS DETERMINED BY BATEMAN (1949)

Species	Dec. Jan. Feb.	March April May	June July Aug.	Sept. Oct. Nov.
Sourwood *(Oxydendrum arboreum)*	O	M	L	L
Sumac, dwarf *(Rhus copallina)*	O	M	M	M
Sweetleaf *(Symplocos tinctoria)*	M	M	L	L
Sycamore *(Platanus occidentalis)*	O	O	M	O
Waxmyrtle *(Myrica cerifera)*	M	M	R	R
Willow *(Salix nigra)*	O	H	M	O
Witch-hazel *(Hamamelis virginiana)*	O	M	L	L
Wild azalea *(Rhododendron canescens)*	O	H	H	M
Yaupon *(Ilex vomitoria)*	H	H	H	H
FORBS				
Beggarweed *(Meibomia spp.)*	O	H	H	L
Blackberry *(Rubus spp.)*	M	M	L	L
Cherokee rose *(Rosa laevigata)*	O	O	H	M
Cocklebur *(Xanthium spp.)*	O	O	R	O
Fern, bracken *(Pteridium aquilinum)*	O	H	M	R
Grape, wild *(Vitis spp.)*	O	H	H	M
Honeysuckle, Japanese *(Lonicera japonica)*	H	H	H	H
Lespedeza, bush *(Lespedeza spp.)*	O	L	M	M
Lespedeza, common *(Lespedeza striata)*	O	O	M	H
Mexican clover *(Richardia scabra)*	O	O	M	M
Muscadine *(Vitis spp.)*	O	M	M	O
Partridge pea *(Chamaecrista spp.)*	O	M	M	O
Poor joe *(Diodia teres)*	O	O	O	M
Potato vine, sweet *(Ipomea batatas)*	O	O	H	H
Ragweed, small *(Ambrosia elatior)*	O	M	M	O
Rattan vine *(Berchemia scandens)*	O	H	H	H
Smilax *(Smilax spp.)*	H	H	H	H
Soybean *(Soja max)*	O	O	H	H
Switch cane *(Arundinaria tecta)*	M	O	O	O
Tea weed *(Sida spp.)*	O	O	H	M
Tie vine *(Thyella tamnifolia)*	O	O	M	M
Yankee weed *(Eupatorium capillifolium)*	O	O	R	R
Yellow jessamine *(Gelsemium sempervirens)*	H	H	H	H
FRUITS				
Acorns *(Quercus spp.)*	H	O	O	H
Corn *(Zea mays)*	H	O	O	H
Crabapple *(Malus spp.)*	O	O	O	H
Mulberry, French *(Callicarpa americana)*	O	O	O	H
Rose hips *(Rosa spp.)*	H	O	O	H

* Palatability: H-high, M-medium, L-low, R-refused, O-not fed.

range and makes up a significant part of the vast Blind River-Maurepas Range discussed in the bottomland section. This well-stocked bottomland range has been contiguous with over 200,000 acres of excellent pine-hardwood range in the remainder of Livingston Parish for more than 20 years, yet deer have not begun seriously to populate the remainder of the parish. A careful investigation of this condition indicates the primary cause to be a lack of protection in the more easily hunted and higher areas to the north. Deer frequently make their way up creek bottoms well up into the parish but, as soon as they are located, legal or illegal hunting pressure begins. With no dense tangles or expanses of water to aid their escape or to slow down the dogs, they are soon killed or chased back into the deeper swamps. There seems to be no other answer to the lack of deer in the pine-hardwoods areas. Deer on protected preserves in the same general area have thrived and have reached a population density of 1 deer in 15 acres. It is believed that, if deer were stocked throughout this area and afforded protection from illegal hunting and from dog hunting, a large deer population would be the result.

The primary limiting factors in this area are general illegal hunting and competition from livestock. Legal hunting should not be considered at all until the herd is well established and then it should be carefully controlled and without dogs.

Deer Potential of the Southeast Terrace Lands and Recommendations for Management

According to findings by Bateman (1949) in this State, the findings in other states, and observations made on this project, the pine-hardwood and terrace land mixed hardwood areas have a carrying capacity of at least 1 deer to 30 or 40 acres. Using 1 deer to 50 acres as a base standard for the carrying capacity of this type range a conservative estimate can be made. At this rate, a population of some 13,000 deer could be built up in the Southeast Terrace Lands. Table 32 lists the distribution of this potential population. For practical purposes, however, the centers of population would be in the Livingston-St. Helena area and the Pearl-Bogue Chitto bottoms. (See deer map–Fig. 14).

Even at the risk of undue repetition, it must be reiterated here, and it is borne out by the findings of Bateman and others that excess populations can and will occur in this area. All management plans should take this into consideration at an early date.

In order to attain the maximum deer populations in this southeastern area, the basic recommendations outlined in the preceding section should be followed. Specifically for this area, the following steps are suggested.

1. Several game management areas should be located over the more northern part of the area. (See map—Fig. 15).
2. Considerable restocking is indicated to supply a breeding potential.
3. The season should be closed in all parts of the area where deer herds are being established for a period of at least 5 years.
4. When the season is finally opened, hunting with dogs should be eliminated if possible, and, if impossible, at least a 2 mile buffer area should be established around all game management areas where dogs are not allowed.

DEER IN THE NORTHWEST LOUISIANA UPLANDS

The Northwest Louisiana Uplands is the second largest ecological division in the State. Its total area is 5,332,750 acres and excepting the Red River Valley, it is predominately pine-hardwoods hill lands. (See ecological description, p. 68). Because of its large size and vast forests, it has an excellent potential as a deer area.

RANGE

The total occupied and potential deer range in the northwest hill lands consists of 2,886,000 acres or 54.1 per cent of the total area. This division has the highest proportion of deer range for its size in the State and the second largest acreage. Not only is this range excellent and vast, but for the most part, it is concentrated in one huge block forming a belt from Natchitoches Parish across Grant, Winn, Jackson, La Salle, into Caldwell and Catahoula Parishes, where it swings up along the Ouachita River to the Arkansas line. (See map, Fig. 6, and Table 34). This area contains 1,860,000 acres and is the largest single block of potential deer range in the State. Table 34 lists the deer ranges, both occupied and potential, by parishes in the Northwest Louisiana Uplands.

The vast majority of the range in the Northwest Uplands is second-growth mixed pine-hardwoods interlaced with mixed bottomland hardwoods along drainage courses. (Plates 12, 13, and 14). The detailed forest types distribution and plant species involved have been described earlier in the ecological description of the area. At this point, it is sufficient to say that the findings in this area are similar to those of Bateman in the Southeast Ter-

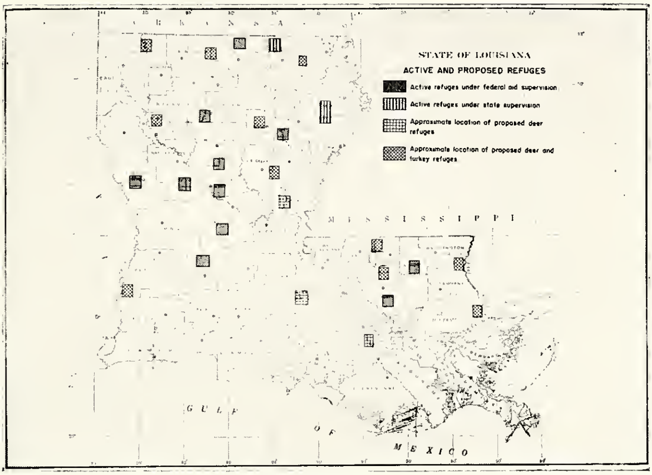

ARKANSAS
STATE OF LOUISIANA
ACTIVE AND PROPOSED REFUGES
Active refuges under federal aid supervision
Active refuges under state supervision
Approximate location of proposed deer refuges
Approximate location of proposed deer and turkey refuges
MISSISSIPPI
GULF OF MEXICO

FIGURE 15.

rane Lands. Apparently, there exists an excellent deer food supply on a vast range, yet, to date, it has remained unoccupied or only sparsely occupied by deer. The reasons for this, like those described for the Southeast Terrace Land pine-hardwoods area, are basically a lack of escape areas from dogs and dog hunting and excessive hunting pressure on small herds in the area; in this area there is also a lack of a source of deer to repopulate the area. These will be discussed more fully below.

Food Conditions on Range

Food conditions on the range are excellent throughout the year. The lowest point in the food production cycle is, of course, winter, but, even then, numerous evergreen foods are available. The types of plants available for food in this area are basically the same as in the pine-hardwoods areas described in detail for the Southeast Terrace Lands. Following is a listing of plants that may be used by deer occurring in the Northwest Louisiana Uplands. (Table 35). This list was made from field observations by the biologist in charge of the deer project on National Catahoula Wildlife Management Preserve. The various plants in the list are marked

TABLE 34

SUMMARY OF DEER INVENTORY – NORTHWEST LOUISIANA UPLANDS

PARISH	Type & Size of Occupied Range		Type & Size of Unoccupied Potential Range		Estimated Present Population	Average Population Density on Occupied Range	Average Annual Kill	Estimated Potential Population	Remarks
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods					
Bienville	20,000[1]			50,000[1]	25	800[2]	Closed season	1,000	No extensive range.
Bossier		25,000[1]	125,000[1]	130,000	10	2,500	C. S.	5,600	Herd too small for successful breeding.
Caddo	28,000	15,000	53,000	30,000	45	955	C. S.	1,680*	Range too scattered.
Caldwell*		60,000		122,000	99	606	C. S.	3,600	Excellent potential range.
Catahoula*		150,000			50	3,000	8	3,000	
Claiborne	22,000		15,000		14	1,571	C. S.	750	Forest too scattered.
DeSoto	20,000		30,000		20	1,000	C. S.	1,000	Range limited.
Grant	8,000	20,000	80,000	210,000	350	80	40	4,240*	Range not yet of good quality.
Jackson	90,000	150,000			200	1,200	C. S.	4,800	Good Potential range.
LaSalle	50,000	80,000		70,000	66	1,969	6	2,660*	Range quality average.
Lincoln	20,000				110	181	C. S.	400	Forest too scattered.
Natchitoches	20,000	40,000	160,000	55,000	200	300		5,500	
Ouachita*			20,000	45,000			C. S.	1,300	
Rapides*			8,000	10,000				360	
Red River		18,000	17,000		15	1,200	C. S.	700	
Union	58,000		121,000	121,000	202*	386	15	6,000	
Webster			25,000		3		C. S.	500	Forest too scattered.
Winn	6,000	14,000	140,000	335,000	600	80	105	9,000	Extensive potential range.
TOTAL OR AVERAGE	342,000	572,000	794,000	1,178,000	2,009	455	174	52,090	

* Includes recently stocked animals.

[1] Acres.

[2] Acres per deer.

according to their usefulness as deer foods after the findings of Bateman (1949).

The above list does not contain all the deer foods in the area and is not meant as a finite list. It is used here to indicate the variety of foods available. In addition to the above species, many grasses and wild legumes are available to deer throughout the area. It is evident from the wide variety of foods that such pine-hardwoods areas have a substantial carrying capacity.

Population Density and Distribution of Deer on the Northwest Upland Area

The total deer population in the Northwest Louisiana Uplands is approximately 2,000 which is quite low for so large and excellent a deer range. Table 34 lists the distribution and density of deer by parishes as well as the kill where the season is opened. An examination of the table will reveal that the bulk of the deer are in the parishes of Winn, Union, Natchitoches, Grant, and Jackson. Here, once again, the evidence points to the fact that protection is a vital factor in managing deer in the pine-hardwoods areas. Refuge areas on national forests in Natchitoches Parish and in the Grant-Winn section contain many of the deer; the deer in Union Parish are, for the most part, in a wooded area adjacent to a refuge in Morehouse Parish. (See map-Fig. 15).

Limiting Factors in the Northwest Louisiana Uplands

At the present time, the annual kill in this area is relatively high, particularly in the vicinity of the Catahoula Refuge. When this area was first studied in 1947-48, the annual legal kill was determined at approximately 35 deer. In 1949 it jumped to an estimated 117 and in 1950 the legal kill was estimated at 103 animals. This indicates two things: the population is pyramiding rapidly and the kill of over 100 legal animals in two successive years was made from a herd of around 1000 animals. While all counts to determine the deer population of this area have resulted in estimates of from 600 to 1000 animals, the legal kill data reported above indicates that the later figure is more nearly correct. It is the opinion of the investigators that excessive dog hunting, violation of the management area by dogs, and the practice of heavily hunting around the management area has even further retarded the normally slow spread of deer from stocked to unstocked areas. Excessive dog hunting and illegal gun pressure

TABLE 35

PLANT SPECIES USED AS DEER FOOD
NORTHWEST LOUISIANA UPLANDS

Woody Sprouts and Young Trees of These Dominant Types	Usage and Palatability*
Beech *(Fagus grandifolia)*	H-M
White Oak *(Quercus alba)*	M-L
Red Oak *(Q. falcata)*	M-L
Water Oak *(Q. nigra)*	M
Elm *(Ulmus americana)*	M
Magnolia *(Magnolia grandiflora)*	H-L
Sweetbay *(M. virginiana)*	M
Ironwood *(Carpinus caroliniana)*	H-M
Red Maple *(Acer rubrum)*	M
SMALLER TREES AND SHRUBS	
Alder *(Alnus rugosa)*	L
Arrow-wood *(Viburnum dentatum)*	H
Azalea *(Rhododendron canescess)*	H-M
Cherry *(Prunus serotina)*	H-M
Chokeberry *(Aronia arbutifolia)*	?
Dogwood *(Cornus florida)*	?
Hawthorn, green *(Crataegus viridis)*	?
Hawthorn, parsley *(Crataegus marshalii)*	?
Holly, decidious *(Iles decidua)*	H
Sweetleaf *(Symplocus tinctoria)*	M
Huckleberry, spring *(Vaccinum eleodia)*	H
Huckleberry, winter *(Vaccinum arboreum)*	M
Waxmyrtle *(Myrica cerifera)*	M-R
Plum *(Prunus americana)*	H
Redbay *(Persea borbonia)*	?
Redbud *(Cercis canadensis)*	?
Silverbell *(Halesia diptera)*	M-L
Snowbell *(Styrax americana)*	?
Virginia willow *(Itea virginica)*	?
Witch-hazel *(Hamemelis virginiana)*	M-L
Yaupon *(Ilex vomitoria)*	H
VINES	
Blackberry *(Rubus* spp.)	M-L
Smilax *(Smilax* spp.)	H
Rattan *(Berchemia scandens)*	H
FRUITS	
Acorns *(Quercus* spp.)	H
Blackberries *(Rubus* spp.)	H

H—Palatability high.
M—Palatability medium.
L—Palatability low.
*—Palatability as determined by Bateman (1949)

H-L or H-M—Indicates palatability varies as indicated at differenr time of the year.

on the edge of the area will hinder the spread of deer to surrounding areas even though over-population may occur on the refuge. This could well be a classic example of how not to manage a deer population. Indeed, if we put all our "eggs" in the refuge "basket" and hope for the magical spread that always affords a bountiful overflow, we are going against the facts of game management.

In addition to the factors discussed above, the ultimate population level and total annual legal harvest will depend upon a number of things: protection from illegal kills, protection from losses due to dog hunting, the degree of future cattle competition, future composition of the forest, and the ability to regulate the harvest so as to protect the range from the deer themselves. There is still a lack of breeding populations on some portions of this range. This can be remedied by stocking and affording the new herds protection.

Deer Potential of the Northwest Louisiana Upland and Recommendations for Management

The deer potential of the vast pine-hardwoods ranges in northwest Louisiana is high even when based on the conservative carrying capacity of 1 deer to 50 acres. In all probability, under proper management, this area would produce a minimum of 45,000 deer and perhaps as many as 90,000. Table 34 lists the estimated potential population by parishes at the most conservative figure set.

In attempting to manage the area, two primary factors should be kept in mind:

1. Good protection must be afforded the population if success is to be expected.
2. Most of the effort, and at least the initial effort, should be aimed at establishing a large herd in the vast belt of range lying across the more southern part of these uplands. See map—Fig. 6). Areas to the north and west of this belt, although favored with good deer range, have a greater amount of farmland, less range in proportion to total area, and a greater human population, all of which make this part of the division less favorable for deer management or hunting.

Recommendations for the improvement of deer conditions and the expansion of the present deer population in the area are as follows:

1. Seasons should be closed over the entire area for a period of 5 years if possible.

2. Dog hunting should be abolished in the area, if possible, and, if not, certainly buffer areas of several miles around each refuge should be established where dogs are forbidden.
3. Areas with populations too low for breeding should be restocked and the season closed in those areas until the herds get started.
4. A constant check should be made on all refuges to determine the effect of the increasing deer population on browse conditions. This is important to prevent over-population. Over-population is always a problem in managed areas and it will become serious more rapidly if the deer are prevented from spreading by hunting with dogs near the refuges. The refuge areas will, in time, reach a condition where it is essential to remove deer by controlled hunting in order to prevent range destruction. With good protection, a similar condition can be expected on any deer range in the State unless the surplus animals can be included in the legal bag as over-population approaches.

DEER IN THE SOUTHWEST TERRACE LANDS (CUT-OVER LONGLEAF PINELAND)

The southwest Terrace Lands or longleaf pine area is a distinct ecological type involving all or parts of seven parishes in the southwestern part of the State. (See map-Fig. 11.) The major characteristics of this area are its rolling denuded hills which once supported solid stands of longleaf pine, its poor sandy soils and its interlacing pattern of scrub hardwood, creek-bottom hardwoods, and pine-hardwoods along the many small streams. (See geological and ecological sections for detailed description of the area & Plates 16, 17, and 18.)

If early historical references can be relied upon, the poor soils and park-like stands of solid longleaf pine areas never produced large quantities of deer. In more recent years, as the timber was cut, the forest game range has been greatly reduced, but the second-growth condition occurring in the bottomland areas has resulted in better deer range. Since the cutting of the forest between 1900-1920, there have been few deer left in the area. Following is a description of the various aspects of the section as a deer area.

Photo by U. S. Forest Service

PLATE 18

Virgin longleaf pine areas (top) and solid pine plantations have too clean and under-story to support significant amounts of game.

Range

The deer range in the Southwest Louisiana Terrace Lands is approximately 717,929 acres or 19.6 per cent of the total area. (See Table 36.) From a food standpoint, the range is of an excellent type, but the widely scattered nature of the forest in narrow strips along streams makes deer management in the area difficult. As long as seasons are closed and the deer unmolested, they will thrive in such an area. On the other hand, the narrow strips of forest afford no protection from dogs or hunters who can form stand lines across the entire bottom. This will result in excessively high kills or else the deer will be forced to run long distances to find cover if they find it at all. There are one or two exceptions to this general range condition. Large blocks of forest do occur in local flatwoods known as "bays" of which the West Bay in Allen Parish is an excellent example and in the larger river bottom areas along the Calcasieu, Whiskey Chitto, and Sabine Rivers. An examination of Table 36 indicates that only a few parishes in the section have more than 100,000 acres of deer range and much of this is scattered and hard to manage.

Food Conditions on the Range

Food on the available range is of an excellent type. Essentially, it consists of the same general group of plants listed for the Southeast Terrace Lands and the Northwest Uplands. The general break down of forests in the area, however, falls into specific range types which are characterized by certain species. In the following list (Table 37) the plants and their palatability to deer are listed separately for each type range. For a complete general list of plants refer to the plant list of the Southwest Terrace Land section in the section on ecological division.

It will be seen from the above list that many deer food plants occur in this area. It is also clear that a wider variety and a greater quantity of foods occur in the river bottom and "bay" areas. In general, however, food cannot be considered a limiting factor in any part of the area except where range area is such that foods may soon be consumed by reasonably large populations.

Population Distribution and Density of Deer in the Area

The present deer population in the Southwest Terrace Lands, as in other pine-hardwoods areas of the State, is exceedingly low.

TABLE 36

SUMMARY OF DEER INVENTORY – SOUTHWEST LOUISIANA TERRACE LANDS (CUT-OVER PINELANDS)

PARISH	Type & Size of Occupied Range		Type & Size of Unoccupied Potential Range		Estimated Present Population	Average Population Density on Occupied Range	Annual Kill	Estimated Potential Population
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods				
Allen	50,000[1]		25,000[1]	25,000[1]	184**	271[2]	Season Closed	2,500
Beauregard	49,000	25,000[1]			183**	404	12	1,400
Calcasieu (N. ¼)*	50,000	20,000			?			1,750
Evangeline (N.W. 1/3)*				30,000				600
Rapides (W. ½)*	6,000	6,000	47,181	64,748	64**	187	Closed	2,460
Sabine	25,000		75,000	120,000	54**	463	Closed	4,400
Vernon	54,000		46,000		180**	300	12	2,000
TOTAL	234,000	51,000	193,181	239,748	665	428	24	15,110

* See other tables for other sections of these parishes.
** Includes recently stocked animals.
[1] Acres.
[2] Acres per deer.

As of 1950, there are 665 deer in the entire area and this includes considerable numbers of recently restocked animals. Table 36 lists the distribution of deer by parishes, the density on the range, seasons, and potential populations. At the time of the original study of this area, deer were present only in the Sabine River bottomlands and in a few other isolated spots. Most of the released deer have been placed on refuges in Allen, Rapides, and Sabine Parishes. Releases in Vernon Parish were made near Sugartown. In general, the season is closed over most of the area excepting in the Sabine River bottoms where deer have never been killed out.

Limiting Factors in the Southwest Terrace Lands

The primary limiting factors to substantial deer herds and successful hunting in the southwest pinelands are two: One is the same as in other pinewoods areas. There is a very great need for stocking and protection for deer and a limiting if not total abolition of dog hunting once the season is opened. In the opinion of all technicians consulted, it is not believed that deer herds can be maintained in the narrow wooded creek bottoms and circumscribed bays if hunted heavily with dogs. On the other hand, good populations and excellent still hunting would go hand in hand in the area. The second major limiting factor is the limited extent of the range. The present size of the range has a safe carrying capacity that should not be exceeded. In due time, reforestation will increase the size of the range, but present efforts should be directed at preventing rapid overpopulations of the area. Other less serious and preventable limiting factors are forest fires, free range grazing by cattle and hogs, and a lack of breeding stock in many parts of the area.

Deer Potential and Recommendations for Management in the Area

The carrying capacity for most of the range in the Southwest Terrace Lands is as high or higher than any other area in the State. It should support at least 1 deer to every 50 acres and probably as many as one in 30 acres in many sections. Basing the potential on the most conservative figure, some 15,000 deer could be produced by good management in these southwest pinelands. Table 36 gives the breakdown of this potential by parishes.

TABLE 37

DEER FOODS—SOUTHWEST LOUISIANA TERRACE LANDS (CUT-OVER LONGLEAF PINE)

CREEK AND RIVER BOTTOMS, INCLUDING FLOOD PLAIN, 1ST AND 2ND BOTTOMS

Cypress *(Taxodium distichum)*	M
Magnolia *(Magnolia grandiflora)*	H-L
Hickory *(Carya* spp.*)*	M
Beech *(Fagus grandifolia)*	H-M
Water Oak *(Quercus nigra)*	M
White Oak *(Quercus alba)*	M-L
Swamp Chestnut Oak *(Quercus primus)*	?
Red Oak *(Quercus falcata)*	M-L
Obtusa Oak *(Quercus obtusa)*	?
Willow Oak *(Quercus phellos)*	?
Ash *(Fraxinus americana)*	M-L
Loblolly Pine *(Pinus taeda)*	?
Red Mulberry *(Morus ruba)*	H
Tupelogum *(Nyssa aquatica)*	?
Sweetgum *(Liquidambar styraciflua)*	M-L
Redbay *(Persea borbonia)*	?
Virginiana Willow *(Itea virginica)*	?
Witch-Hazel *(Hamemelis virginiana)*	M-L
Dogwood *(Cornus florida)*	H-M
Holly *(Ilex opaca)*	L
Blackgum *(Nyssa sylvatica)*	H-M
Willow *(Salix nigra)*	H-M
Birch *(Betula nigra)*	?
Bitter Pecan *(Carya aquatica)*	?
Red Maple *(Acer rubrum)*	M
Buttonbush *(Cephalanthus occidentalis)*	M-L
Witch-Hazel *(Hamemelis virginiana)*	M-L
Arrow Wood *(Viburnum dentatum)*	?
Ironwood *(Ostrya virginiana)*	M-L
Buckeye *(Aesculus pavia)*	?
French-Mulberry *(Callicarpa americana)*	H-M
Candleberry *(Sebastiana ligustrina)*	?

"BAYS"—FLATWOODS—POORLY DRAINED AREAS

Loblolly Pine *(Pinus taeda)*	
Willow Oak *(Quercus phellos)*	?
Obtusa Oak *(Quercus obtusa)*	?
Water Oak *(Quercus nigra)*	M
Blackgum *(Nyssa sylvatica)*	H-M
Yaupon *(Ilez vomitoria)*	H
Sweetbay *(Magnolia virginiana)*	H-M
Arrow Wood *(Viburnum dentatum)*	?
Redbay *(Persea borbonia)*	?
Winterhuckleberry *(Vaccinium arboreum)*	H-M
Summerhuckleberry *(Vaccinium elliottii)*	H-M
Horsesugar *(Symplocos tinctoria)*	M-L

SMALL STREAMLETS, SPRING HEADS, LOCALLY "GREEN HEADS"

Gallberry *(Ilex glabra)*	?
Black Adler *(Alnus rugosa)*	L
(Viburnum nudum)	H
Sweetbay *(Magnolia virginiana)*	H-M
Waxmyrtle *(Myrica cerifera)*	M
Fringetree *(Chionanthus virginica)*	?

EDGES BETWEEN CREEK BOTTOMS OR FLATWOODS AND PINE BARRENS

Chinquapin *(Castanea alnifolia)*	M-L
Crab Apple *(Malus angustifolia)*	H
Black Cherry *(Prunus serotina)*	H-M
Yaupon *(Ilex vomitoria)*	H
Sassafras *(Sassafras albidum)*	H-M
Wild Azalea *(Rhododendron canescens)*	H-M
Arrow Wood *(Viburnum dentatum)*	?
Silverbell *(Halesia diptera)*	M-L
Snowbell *(Styrax americana)*	?
Black Adler *(Alnus rugosa)*	L
Mayhaw *(Crataegus opaca)*	?
Parsley Hawthorn *(Crataegus marshalii)*	?
Titi *(Cyrilla racemiflora)*	H-M
Summerhuckleberry *(Vaccinium elliottii)*	H-M
Witch-Hazel *(Hamemelis virginiana)*	M-L

PALATABILITY TO DEER AS DETERMINED BY BATEMAN (1949)

H—high palatability.
M—medium palatability.
L—low palatability.
H-M, M-L, H-L —Range of palatability at various seasons as indicated.
?—Utilization undetermined.

In order to attain this potential the following recommendations are suggested, some of which are already in effect.

1. Restock those areas having an inadequate breeding population.
2. Keep the season closed until the populations are well advanced.
3. Abolish dog hunting in the area if maximum populations are to be expected but, as an alternative, create buffer zones around all refuges where only still hunting is allowed.
4. Carefully regulate hunting to prevent excessive kill at first and over-population at a later date.

DEER IN THE SOUTHWEST LOUISIANA PRAIRIE LANDS

As has been pointed out in the description of this area earlier in the report (see ecological description), this area was never heavily forested and, at the present time, is extensively farmed. For the practical reason that very little deer range exists in the area, this section should not be considered as suitable for deer management. The general description of deer conditions may be briefly summarized as follows:

Range

The total deer range in the area is only 190,000 acres or about 8 per cent of the area. This limited forest is scattered over all or parts of 7 parishes and is confined to narrow strips along streams and to a few of the less well drained areas. The bulk of the range available is in the southern fringe of the section as it joins the marsh and the lower Mermentau flood plain. Table 38 lists the available range in the area by parishes.

Food Conditions on Range

The food on the available range can well sustain deer. It is similar to that found in other bottomland areas of the State. The list of plants in the ecological section indicates the basic types suitable for deer food.

Limiting Factors, Potential, and Recommendations

As far as could be determined, there are no deer in the prairie section proper, although fringe areas in the coastal marsh may have small populations. The deer potential of the area is poor, obviously

TABLE 38

SUMMARY OF DEER INVENTORY—SOUTHWEST LOUISIANA PRAIRIELANDS

PARISH	TYPE & SIZE OF OCCUPIED RANGE		TYPE & SIZE OF UNOCCUPIED POTENTIAL RANGE		ESTIMATED PRESENT POPULATION	AVERAGE POPULATION DENSITY ON OCCUPIED RANGE	ANNUAL KILL	ESTIMATED POTENTIAL POPULATION
	Swamp and bottomland hardwoods	Pine-hardwoods and upland hardwoods	Swamp and bottomland hardwoods	Pine-hardwood and upland hardwoods				
Acadia			45,000[1]					900
S. 4/5 Calcasieu*			30,000					600
E. 2/3 Evangeline*			30,000					600
Jefferson Davis			13,000					260
Lafayette			20,000					400
W. 1/5 St. Landry*			10,000					200
Vermilion			40,000					800
TOTAL			188,000					3,760

[1] Acres.

* See other tables for information on remainder of these parishes.

because of the very limited range. Deer can and perhaps should be placed in the area, but there are many better areas throughout the State that should have priority in the State's deer management program. If deer are managed in the area, a peak population of 3,000 to 4,000 is all that can be expected.

DEER IN THE COASTAL MARSHES OF LOUISIANA

As pointed out earlier in the report (ecological section), the coastal marshes of Louisiana are ecologically unique, not only in Louisiana, but in the entire United States. Unfortunately, this vast area forming a 10 to 40 mile belt between the high lands and the beach does not readily lend itself to investigation without considerable time and equipment. From a game standpoint, the area is one primarily suitable for fur production and waterfowl. Since a recent investigation of fur conditions in this area has been published earlier by O'Neil (1949), and since a current waterfowl project is being expanded to study the details of waterfowl conditions, this study did not include a detailed investigation of the marsh and so this report dwells on deer conditions only as they were determined from various other marsh investigators.

Range

There is no definite way to determine the exact extent of occupied or unoccupied range in the marsh. Table 39 lists the total possible range and deer have been known to move into all parts of the marsh except deep water areas or floating areas. In general, the bulk of good range is confined to the scrub cypress-tupelo forest along the upper edge of the marsh in the parishes of Lafourche, St. Mary, and Terrebonne. Numerous other deer herds are scattered on the higher ridges, natural levees, "chenieres", and high isolated sea beaches. Table 39 lists the total range and the estimated population for the various parishes involved. No attempt was made to determine kill nor is there enough information on hand to estimate density or total potential.

Foods on the Range

O'Neil's study (1950) of the marsh plants and the compiled list of the various indicator species (Table 23) are the most recent information on plants in the marsh. These do not, however, indicate those palatable to deer nor the primary types on the higher areas frequented by deer. Presumably the scrub cypress-tupelo areas in the

TABLE 39

SUMMARY OF DEER INVENTORY—COASTAL MARSH AREAS

PARISH	TYPE & SIZE OF OCCUPIED RANGE		TYPE & SIZE OF UNOCCUPIED POTENTIAL RANGE		Estimated Present Population	Average Population Density on Occupied Range	Annual Kill	Estimated Potential Population
	Swamp and bottomland hardwoods	Coastal and tidal marsh	Swamp and bottomland hardwoods	Coastal and tidal marsh				
Cameron	1,000[1]	809,753[1]			100x	xx	xx	xx
Iberia	*	123,929			2,000			
Jefferson	38,000	214,413			1,000			
Lafourche	*	421,772			4,000			
Orleans	6,000	45,000			800			
Plaquemines	7,000	585,599			1,000			
St. Bernard	24,000	290,400			1,000			
St. Charles	69,000	97,024			1,000			
St. Mary	*	223,391			5,000			
Terrebonne	96,000	727,050			5,000			
Vermilion	*	390,967			1,600			
TOTAL	241,000	3,929,298			22,500			

* Bottomland hardwood sections of these parishes in Table 28.

x The size of the marsh area and the difficulties involved in an inventory precluded a detailed study of the area. The figure here represents the best available estimate for the area.

xx Average population in densities on a few known areas ranged from 1 deer in 100 to 1 deer in 350 acres. Other information undetermined.

[1] Acres.

fresh water portion of the marsh furnish similar foods to those in the cypress-tupelo areas in the lower Mississippi alluvial plains. Table 6 lists most of the important species involved here. On "chenieres" and sea beaches, tidal and saline conditions govern plant types. On the higher ridges in fresh water areas, willow (*Salix nigra*), hackberry (*Celtis laevigata*), cottonwood (*Populus deltoides*), live oak (*Quercus virginiana*), buckbrush (*Baccharis halimifolia*), waxmyrtle (*Myrica cerifera*), and grasses make up the bulk of the vegetation on the ridge. In wet areas, cattail (*Typha* spp.) and alligator weed (*Alternathera philoxeroides*) are avidly used by deer. In more saline areas, honey mangrove (*Avicennia nitida*), various species of *Scirpus*, needle grass (*Juncus roemerianus*), and salt grass (*Distichlis spicata*) are prevalent. All through the marshes on natural levees and higher areas, legumes, vines, and various grasses are prevalent the year round. Much work needs to be done on the use of the various marsh plants by deer, but the very existence of a substantial deer population in the area indicates that food is plentiful.

Population Potential and Recommendations

The total deer population in the marsh is roughly estimated at 22,500. The breakdown of distribution by parishes is given in Table 39. No organized deer hunting takes place over the entire marsh but fringe areas are heavily hunted. The over-all kill for the marsh is presumably negligible because of the inaccessibility of most of the deer, either because of their isolation or the difficulty of hunting marsh lands. Present populations, at least in some areas, seem stable. The deer population on Marsh Island where no hunting occurs fluctuates with conditions. Hurricanes, high tides, insects and disease all take a toll and evidently the population has reached its peak, but fluctuates from year to year depending upon conditions.

Not enough is known of marsh deer conditions to make recommendations. It could serve as a source of deer for restocking upland areas, but to date, no efficient method has been devised to trap them from this type habitat. It is doubtful if the area will ever furnish deer hunting to large groups of hunters unless restrictions on land become less severe in the future.

Wild Turkey

The eastern wild turkey (*Meleagris gallopavo silvestris* Vieillot) is native to Louisiana, although in recent years its numbers have been greatly depleted. At the time of this and other recent inventories, the population was so low that there was grave danger this fine bird might disappear from the State. Since then, however, extensive restocking experiments have been set up by the Louisiana Department of Wildlife and Fisheries and the total number of released birds has exceeded the entire native turkey population. At the time of this writing, it is not clear what effect this will have on the native strain of turkey, but there is evidence to indicate survival and breeding of released birds on certain refuge areas.

Fortunately, investigations of turkey conditions in Louisiana have been carried out in the past 10 years. G. H. Bick working on Louisiana Federal Aid Project No. 3-R inventoried the turkey of the State in 1941-42. Although his investigations were interrupted by the recent war, an initial publication setting forth turkey conditions in the State was presented by him. In 1946, this same project was reopened under the leadership of F. D. Hollis who repeated the inventory after a five year period for comparative purposes and who completed the original project objectives. This work was published in 1950 by the Louisiana Department of Wild Life and Fisheries. Mr. Hollis was then transferred to this general inventory project and continued to work on turkey conditions as well as on the general inventory.

This discussion of the wild turkey in Louisiana will present briefly the findings of this and the earlier inventory, the turkey potential of the State, and the recent changes in turkey distribution and population as brought about by the restocking program.

RECENT HISTORY OF THE TURKEY IN LOUISIANA

Early historical accounts of the wild turkey by DuPratz (1758), Shultz (1810) and Joutel (1846) indicated that this bird ranged over the entire State and occurred in considerable numbers. They also indicated that it was a choice food of the early settlers as well as in great demand on the open market.

More recent investigators, including Beyer (1900), Kopman (1907), Beyer, et al (1908), McIlhenny (1914), Bick (1942) and Hollis (1950), conclude that turkey were probably plentiful in the uplands and pine-hardwoods sections of the State originally and until as late as 1880, but were either absent or rare in the cypress-tupelo swamp areas, prairie region, and the coastal marshes. Compare turkey range map—Fig. 16—and forest type map—Fig. 12.

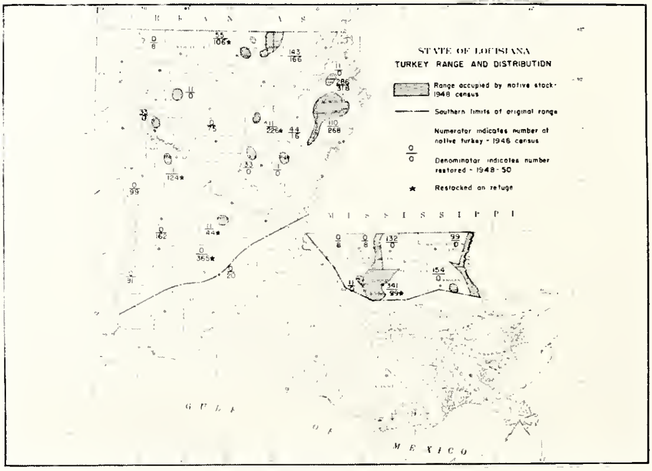

STATE OF LOUISIANA
TURKEY RANGE AND DISTRIBUTION
Range occupied by native stock-1948 census
Southern limits of original range
Numerator indicates number of native turkey - 1948 census
Denominator indicates number restored - 1948-50
Restocked on refuge
MISSISSIPPI
GULF OF MEXICO

FIGURE 16.

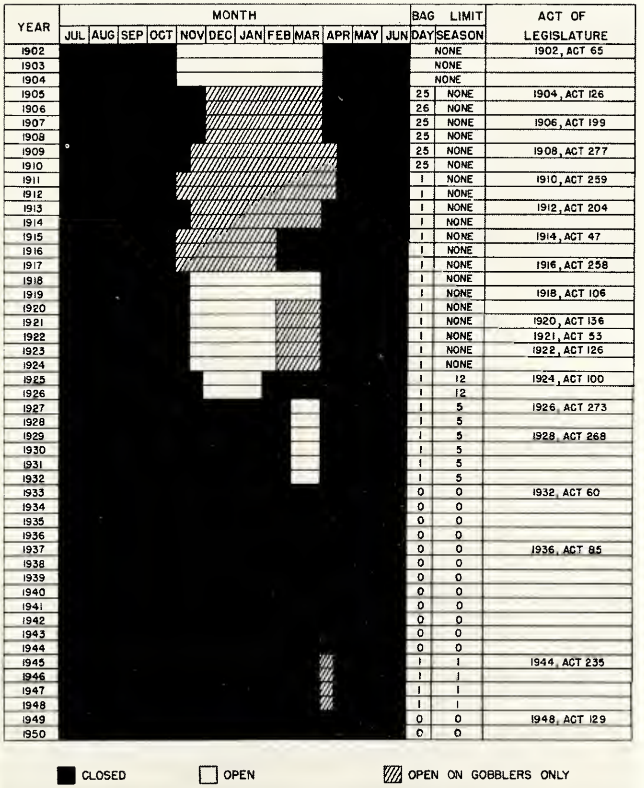
Evidence, gathered by Bick (1941) and Hollis (1950) and on this inventory, indicates that the great turkey populations of Louisiana disappeared as the range was reduced and were almost eliminated by timber operations between 1880 and 1900. This loss of

TABLE 40

LATEST KNOWN RECORD OF TURKEYS IN 20 PARISHES*

PARISH	DATE	OBSERVER
Avoyelles		No records available
Beauregard	1940	Chuyler Gill
Bossier	1935	G. H. Lowery
Caddo		No records available
Calcasieu	1939	Dr. W. A. K. Seale
Claiborne	1911	J. N. Brown
Concordia	1916	T. H. Forman, Jr.
DeSoto	1936	C. H. Harris, Jr.
Evangeline	1941	E. A. Butler
	1940	W. R. Vailot
Grant	1937	B. H. Lemoine
Jackson	1941	T. H. Kilpatrick
Lincoln	1941	Jos. Singer
Ouachita	1940	J. L. Frost
Richland	1940	Mark B. Cooper
Sabine	1939	W. D. Davis, Jr.
Tangipahoa	1940	Recy Hussar
Vernon	1938	H. B. Marcus
Webster	1925	J. E. Long
West Carroll	1936	Allan Hawsey
West Feliciana	1938	T. H. Martin

* After Hollis. (1950)



YEAR	BAG LIMIT DAY	BAG LIMIT SEASON	ACT OF LEGISLATURE
1902	NONE		1902, ACT 65
1903	NONE		
1904	NONE		
1905	25	NONE	1904, ACT 126
1906	26	NONE	
1907	25	NONE	1906, ACT 199
1908	25	NONE	
1909	25	NONE	1908, ACT 277
1910	25	NONE	
1911	1	NONE	1910, ACT 259
1912	1	NONE	
1913	1	NONE	1912, ACT 204
1914	1	NONE	
1915	1	NONE	1914, ACT 47
1916	1	NONE	
1917	1	NONE	1916, ACT 258
1918	1	NONE	
1919	1	NONE	1918, ACT 106
1920	1	NONE	
1921	1	NONE	1920, ACT 136
1922	1	NONE	1921, ACT 53
1923	1	NONE	1922, ACT 126
1924	1	NONE	
1925	1	12	1924, ACT 100
1926	1	12	
1927	1	5	1926, ACT 273
1928	1	5	
1929	1	5	1928, ACT 268
1930	1	5	
1931	1	5	
1932	1	5	
1933	0	0	1932, ACT 60
1934	0	0	
1935	0	0	
1936	0	0	
1937	0	0	1936, ACT 85
1938	0	0	
1939	0	0	
1940	0	0	
1941	0	0	
1942	0	0	
1943	0	0	
1944	0	0	
1945	1	1	1944, ACT 235
1946	1	1	
1947	1	1	
1948	1	1	
1949	0	0	1948, ACT 129
1950	0	0	

THE WILD TURKEY SEASON IN LOUISIANA, 1902 - 1950

FIGURE 17.

range coupled with heavy hunting pressure caused the disappearance of turkey from many parishes between 1910 and 1941. Table 40 shows the last reported record of turkeys in 20 parishes which by 1942 had no turkey. Trends in turkey hunting regulations between 1902 and 1950 reflect the rapid decline in populations. (See Fig. 17). It is evident that as the turkey populations became smaller, some effort was made to protect the remaining flocks by season and bag restrictions. This could only partially help since one of the basic causes for the decline of population was the destruction of range which could only be replaced by time sufficient to regrow the forest.

OCCUPIED AND POTENTIAL TURKEY RANGE IN LOUISIANA

The present range occupied by turkey as determined on this inventory is some 1,068,150* acres or approximately 5.0 per cent of the estimated original range in Louisiana. In addition to this occupied range, there is a maximum potential range of approximately 4,200,000 acres. (See Tables 41-a and 6). This is the absolute maximum estimate, however, based upon the amount of mature second-growth areas now in existence, which once carried a turkey population and which, it is presumed, can do so again. In reality, some of this potential range will not be suitable for turkeys in the immediate future because the configuration of certain parts of the range and its general small size and lack of isolation will prevent practical turkey management. When this loss of range is considered, the total immediately usable potential range in Louisiana probably drops below 2,500,000 acres.

RANGE REQUIREMENTS FOR TURKEY

According to Bick (1941),-Mosby (1943), Wheeler (1946), Hollis (1950), and others, the ideal forest for turkey should be of mixed types of trees with hardwoods predominating. Oaks should comprise the largest part of the stand, as they, with other mast producing species, will provide a large part of the fall and winter food supply. Interspersed with these dominant types should be a great diversity of subdominant types and shrubs to furnish an ample supply of food. A luxuriant herbaceus layer is desirable from the standpoint of green foods and the under-story of the forest be fairly open and park-like.

The following plants are characteristic of the occupied turkey range in Louisiana: oaks (*Quercus spp.*), sweetgum (*Liquidambar styraciflua*), magnolia (*Magnolia grandiflora*), bay (*Magnolia spp.*), blackgum (*Nyssa sylvatica*), hawthorn (*Crataegus spp.*), holly (*Ilex spp.*), dogwood (*Cornus spp.*), greenbriar (*Smilax spp.*), grape and muscadine (*Vitis spp.*), rattan (*Berchemia scandens*), and huckleberries (*Vaccinium spp.*).

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*This includes range occupied by recently released turkeys. There were an estimated 768,640 acres occupied by native turkey in 1949.

TABLE 41-a
TURKEY INVENTORY DATA BY PARISHES

Parish	Total Forest Acreage	Occupied Forest Acreage	Per cent of Forest Occupied	Est. No. Native Birds	No. Birds Stocked 1948-50*	Total No. Birds	Density Acres/Bird	Estimated Potential Range Acreage
Allen	421,104	30,000	7.1	0	365	365	82	100,000
Beauregard	667,756	20,000	2.9	0	91	91	219	113,000
Bienville	357,128	7,680	2.2	11	11		698	100,000
Caldwell	304,721	25,000	2.1	11	226	237	105	150,000
Catahoula	352,312	7,680	2.2	11	0	11	698	100,000
E. Baton Rouge	133,056	7,680	5.8	11	0	11	698	25,000
E. Carroll	135,000	7,680	5.6	11	0	11	698	25,000
E. Feliciana	144,888	7,000	4.8	0	8	8	875	50,000
Evangeline	257,853	10,000	3.8	0	20	20	500	20,000
Franklin	226,100	25,000	11.0	44	16	60	416	75,000
LaSalle	365,983	23,680	6.4	33	0	33	717	175,000
Livingston	236,551	153,600	64.9	341	99	440	349	200,000
Madison	313,207	115,200	36.8	286	318	604	190	150,000
Morehouse	331,940	87,040	26.2	143	166	309	280	150,000
Natchitoches	624,249	47,000	7.5	11	124	135	348	250,000
Rapides	635,660	18,000	2.8	11	44	55	327	250,000
Red River	132,195	23,680	17.9	33	0	33	717	50,000
Sabine	531,158	30,000	5.6	0	99	99	303	200,000
St. Helena	201,131	57,600	28.6	132	0	132	436	100,000
St. Tammany	472,037	98,560	23.1	154	0	154	640	140,000
Tensas	271,419	51,840	19.1	110	268	378	137	125,000
Union	405,770	50,000	12.0	55	106	161	310	140,000
Vernon	728,508	50,000	6.8	0	162	162	308	100,000
Washington	300,610	46,080	15.3	99	0	99	465	120,000
Webster	203,078	8,000	3.9	0	8	8	1,000	60,000
W. Feliciana	136,748	8,000	5.8	0	8	8	1,000	35,000
Winn	543,531	45,000	8.2	0	75	75	600	200,000
TOTAL	9,433,693	1,068,150	11.3	1,507	2,203	3,710	287	3,203,000
Remainder of State's turkey range[1]	3,406,510	....	......	....	....	....	....	1,013,000
Total turkey range—State[2]	12,840,203	1,068,150	8.3	1,507	2,203	3,710	287	4,216,000

[1] Parishes having potential turkey range listed here are: Bossier, Caddo, Concordia, Claiborne, DeSoto, Grant, Jackson, Lincoln, Ouachita, Richland, Tangipahoa, West Carroll.

[2] This represents total turkey area in State.

*Approximately 20% of released birds believed to have died because of shipping injuries.

TABLE 41-b

TURKEY INVENTORY DATA BY ECOLOGICAL DIVISIONS*

Ecological Division	Total Forest Acreage	Occupied Turkey Range[1]	Per cent Forest Occupied	No. of Native Birds	Density Acres/bird (Native)[2]	No. Released 1948-50[3]	Total Birds	Density Acres/bird Total Birds	Estimated Potential Range	Estimated Potential Population[4]
Southeast Louisiana Terrace Lands (Fla. Phs.)	1,961,917**	378,520**	19.29	737	493**	92	829	456**	730,000**	1,536
Upper Mississippi Alluvial Plain	2,455,975	293,910	11.96	594	486	796	1,390	211	820,000	1,726
Northwest Louisiana Uplands	5,332,750	237,720	4.46	165	659	251	416	571	2,003,000	4,216
Southwest Louisiana Terrace Lands (S. W. Pine)	3,089,561	158.000	5.11	11	698	625	636	248	663,000	1,395
Totals and averages	12,840,203	1,068,150	8.32	1,507	510	1,764	3,241	330	4,216,000	8,873

[1] Includes range that has been restocked.

[2] Based only on range occupied by native birds.

[3] These figures less than the total in Table 41-a because 20% deducted for injury loss in shipment.

[4] Based on carrying capacity of 475 acres per bird.

* Only those divisions included that are within range of the turkey.

** All figures in these columns in acres.

TABLE 42

HYPOTHETICAL SPECIFICATIONS FOR IDEAL WILD TURKEY HABITAT IN LOUISIANA*

I. FOREST COMPOSITION (Food and Cover)
  A. Forest over 75% to 90% of range
    1. Hardwoods at least 50% and oaks at least 25% of forest
    2. Diversity of forest types, with several types well mixed
    3. Interspersion of minor types which produce mast and berries *(Cornus, Crataegus, Viburnum, Vitis, Smilax)*
  B. Openings 10% of range
  C. Forest and openings well interspersed, not in large blocks
  D. Roosting sites and escape cover, either coniferous or cypress-tupelo stands

II. TERRAIN
  A. Not too large a percentage of swamp, or overflow land; not too large a percentage of cut-over lands
  B. Rolling to precipitous terrain
  C. Numerous small streams and lakes throughout range

III. SETTLEMENT AND CULTIVATION
  A. Low rural population (less than 20 persons per square mile)
  B. Cultivated land in small blocks, not more than 15% of total; open farmland not more than 20% of total
  C. Timber operations carried out according to good forestry practices, never clean cutting of a major type
  D. Portion of range well isolated and inaccessible to humans, and free from human interference
  E. Nesting sites available in unmolested areas

IV. PROTECTION
  A. A part of all of range posted against all hunting
  B. A human population sympathetic to needs of the wild turkey
  C. Adequate escape cover and roosting sites
  D. Range not readily accessible by good roads, and relatively free from human interference
  E. Nesting sites available in unmolested areas

V. GENERAL
  A. Size: minimum at least 10,000 acres; optimum 50,000 acres or more
  B. Range free of grazing by hogs and cattle
  C. Uncontrolled fires held to a minimum
  D. Area free of high deer population

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* After Hollis. (1950)

Hollis (1950) from his findings and from a study of the literature has prepared a description of a composite ideal turkey range in Louisiana. Table 42 is taken directly from his publication.

It becomes obvious from the findings on this inventory and from Hollis (1950), Wheeler (1946), Mosby (1943), and others that the requirements for turkey habitat are critical. Large amounts of range containing all of these factors are extremely difficult to find. If the requirements for a turkey range are compared to the description of the various ecological divisions of the State, it becomes evident that suitable range requirements can be found only in the two terrace regions, the Northwest Uplands and the

Upper Mississippi Alluvial Plains. It is also evident that requirements such as maturity of forest, amount of hardwoods, and size of forest will greatly restrict the amount of range within an ecological division.

POPULATION DENSITY AND DISTRIBUTION

The total turkey population at the present time is estimated to be between 3,200* and 4,000*. This includes the native population determined in this investigation plus the recently released populations. It does not attempt to figure the natural increment since the season was closed in 1949. A comparison of the changes in total populations in the past 10 years is listed below:

	Population 1942 (Bick)	Population 1946 (Hollis)	Population 1947-48 (this project)	Population after restocking 1949-50
No. Flocks	158	133	137	337**
No. Birds	1,738	1,463	1,507	3,710

**This is the equivalent number of flocks based on 11 birds to the flock. Actual group releases were larger than this in some cases.

*The total population including all birds released is approximately 3700, but an estimated 20% of released birds died because of injuries received in shipment.

From the above table, it is evident that little change occurred in the time elapsing between the completion of Hollis's work in 1946 and this work in 1947-48. The loss of a few flocks occurred in the Tensas-Madison area because of timber operation, but the findings in Livingston Parish indicated an increase of eight flocks there. Since the releasing program has become effective, the State's turkey population has been more than doubled. (See Table 41-b). The turkey map (Fig. 16) indicates the location of the native population and the releases.

SEASONS, HUNTING PRESSURE, AND KILL

Since 1949 there has been no legal open season on turkey. Prior to 1949 there was a 10-day season with a 1-gobbler bag and season limit for the period 1945-48. Before this the season had been closed for ten years. (See chart-Fig. 17.) For all practical purposes, the legal hunting pressure and kill has been non-existent for nearly 20 years. So few birds were taken between 1945-48 that agitation for a closed season soon started.

Illegal hunting has been another story. Although there is little authentic evidence, report after report indicated that many turkeys were taken illegally until quite recently. One of the commonly used methods of illegal hunting seems to be to use bird dogs on young poults during the summer and fall months. In such cases, entire flocks may be wiped out by one hunter. There is no way to determine the total amount of turkey taken illegally, but in certain areas it is evidently high. More than likely, the illegal kill represents the principal loss from hunting that has occurred in the State.

GENERAL LIMITING FACTORS AND TURKEY POTENTIAL

The primary limiting factor to the establishment of large turkey populations in Louisiana is the limited extent of good range. From the findings of various authorities on turkey discussed above it is evident that the critical nature of range requirements for turkeys greatly limits the amount of available range in the State. Another important limiting factor is the widespread use of the available turkey areas by free-ranging cattle and hogs which causes competition for food between stock animals and turkeys and also results in a general disturbance of the area by both livestock and stockmen. This latter fact destroys much of the isolation so necessary for turkeys. The present small number of birds in the State is below a level of population necessary to insure production in all areas. Many good ranges are totally devoid of birds. Since the population is low, illegal hunting and predation probably play a larger part in limiting population increases than might be normally expected.

The turkey potential for the State is governed primarily by its total turkey range. Population densities per unit area for this State are approximately the same as in other States in the Southeast. Should the unoccupied ranges in Louisiana become populated, the total population ought to exceed 9000 birds. This population should furnish reasonably good hunting if kills are carefully regulated. In Louisiana, turkeys can, in all probability, be managed successfully on the Southeast and Southwest Terrace Lands, the Northwest Louisiana Uplands, and the Upper Mississippi Alluvial Plain. Each of these ecological divisions will be discussed separately in regard to turkey range, potential, and recommendations for management.

SOUTHEAST LOUISIANA TERRACE LANDS (FLORIDA PARISHES)

The Southeast Louisiana Terrace Lands apparently have the best turkey habitat in the State. This is indicated by the fact that 49 per cent of the entire State's population of native birds were found in the area. The exact reason for this is not known. Most of the turkeys in this area are in the vast pine-hardwood and bottomland hardwood areas of Livingston and St. Helena Parishes, but some are found in the Honey Island area of the Pearl River bottomlands. A re-examination of the plant types and forest make-up of these areas (see Tables 14 and 15) will, in general, show typical pine-hardwoods and mixed bottomland hardwoods characteristic of many other areas in the State. There is, perhaps, no definite line of demarkation that can be drawn between this and other areas that could account for this greater population of native turkeys; however, listed below are some facts that may have caused large populations. These are as follows:

1. Slightly better soils than in other similar regions, resulting in more luxuriant plant growth and, therefore, better food production.
2. The occurrence of certain plants exclusively or else more abundantly in this region than in other regions. Some of these plants that might be contributory to better turkey range are live oak, turkey oak, slash pine, spruce pine, running chinquapin, several magnolias, starbush, titi, several species of *Ilex*, fetterbush, hairy huckleberry, blueberry, and devilwood.
3. The fact that this area was cut as early as any in the State and has had time to reach second-growth maturity, thereby furnishing the necessary mast-producing trees for food and suitable roosting sites.
4. A greater percentage of hardwoods on the better soils of the area. (This is true in comparison to other pine-hardwoods areas, but does not hold when comparing it to the Tensas-Madison area of the Upper Mississippi Alluvial Plain.)
5. Large original breeding potential. (This, however, should have been more than offset in this area by illegal kills which are reported to be the highest in the State.)

The present population in this ecological division is an estimated 737 native birds carried on some 363,520 acres of occupied range. This is an average density of one bird to 493 acres and it falls well within the range of average turkey population densities as determined by Mosby and Handley (1943), Wheeler (1946), and others. Using an estimated carrying capacity of one bird to 475* acres as a basis for computation, the potential turkey population for the estimated 730,000 acres of occupied and potential range in the area is around 1536 or roughly double the present population. (See Table 41-B)

To attain the maximum turkey potential certain limiting factors must be overcome. The primary ones of this area are these: (1) all forms of illegal hunting, (2) competition from free ranging hogs for the acorn crop, and (3) the lack of general isolation or protection from disturbance.

To overcome the above limiting factors, the following recommendations are suggested: (1) Establish refuges specifically aimed at protecting and building up the native turkey population to a level that will allow some to be removed for restocking. Such refuges should, if possible, be selected in the best occupied range, fenced with hog-proof fence, and be kept constantly under the supervision of qualified personnel. (2) Establish a trapping and restocking program to replenish areas that lack a breeding potential. If possible, all birds released should be native wild stock taken from heavily populated refuge areas. (3) Keep the season closed until the populations become of huntable size. (4) Protect the turkeys in all areas by strict enforcement and an educational program aimed at getting the local people interested in protecting and saving their native turkeys. (5) Try to educate the public toward eliminating the free ranging of hogs and cattle on turkey range. (6) Establish turkey management in any part of the range found suitable.

UPPER MISSISSIPPI ALLUVIAL PLAIN

The Upper Mississippi Alluvial Plain has the second highest native turkey population in the State. It was found to carry 40 per cent of the State's turkeys. The reason for the presence of a relatively large population in this ecological division is somewhat more easily explained than for the southeastern section of the State. In this area, most of the turkeys are confined to the Madison-Tensas area on a large refuge that contains some of the only virgin mixed bottomland hardwoods that remain in the State. In this virgin hardwood forest with the additional protection of a refuge, turkeys have done well. The value of the mature forest in this area as the basic reason for the maintenance of the native turkey population is clearly marked by two factors: (1) Turkeys have not been found to any extent in recently cut-over areas nor have they moved from maturely forested areas to adjoining younger areas; (2) In recent years, timber operations in the refuge area have brought about a marked drop in turkey population. Hollis (1950) reports a loss of fifteen flocks of birds from this area between 1941-1946 because of a reduction in range due to cutting timber. The investigations on this project found these losses were increasing as the timber operations and land clearing in the State have continued. There are other important factors contributing to good turkey conditions in this area: (1) The protection afforded by the Singer-Ayres Refuge and the Terzia Refuge in Madison, Tensas, and Morehouse Parishes. Forty-eight of the fifty-nine flocks in this division were found on and around these refuges. (2) Not at all of least importance has been the interest taken by the local population in protecting their turkey flocks.

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*An average carrying capacity of one bird to 475 acres is believed to be a conservative estimate for the average type range in Louisiana.

The present population of native turkey in the Upper Mississippi Alluvial Plain is approximately 605 birds, these are carried on a range of some 281,000 acres. This is a density of approximately 1 bird to 464 acres, which is near the average population density determined for other good areas by various turkey authorities. The total potential of the area, based on a carrying capacity of 1 bird to 475 acres and the estimated total potential range of 820,000 acres, is approximately 1726 birds. (Table 41-b) With good protection and management established in the area, the carrying capacity and total population could no doubt be increased significantly beyond 1726 birds. On the other hand, one of the major limiting factors in the area is now and will continue to be the reduction of range because of timber operations and the clearing of land for farms.

All indications are that this practice will increase in the area rather than decrease. Since this is the case, the future of turkey conditions in this region is not too clear. Following are some recommendations that, if put into effect, should preserve and probably increase the turkey populations in the area.

1. Establish management areas aimed specificially at turkey management on some of the areas where virgin or mature hardwood forests still remain.
2. Manage such areas intensively and extend turkey management to any other suitable ranges throughout the area.
3. Keep the season closed for as long as necessary to build up a huntable population.
4. Restock any good ranges that have too low a breeding potential.

NORTHWEST LOUISIANA UPLANDS

The Northwest Louisiana Uplands at present contain only 11 per cent of the total turkey population in the State, but this extensive area may prove to be the salvation of the wild turkey in Louisiana. As pointed out in the discussion of the Southeast Louisiana Terrace Lands, there are no definitely known reasons why there should be larger turkey populations in the terrace area and not in other pine-hardwoods areas. A comparison of the characteristics of these two ecological divisions will show that both contain all of the basic plant types required for good turkey range. (Compare Tables 11, 12, 14, 15 and 42) Furthermore, the southern part of the Northwest Upland division contains the largest contiguous block of forest suitable for deer and turkey range in the State. (See map, Fig. 6) The primary conditions that may have contributed to the dearth of turkey in the area to date are these: (1) lack of mature forest until the present time when the new growth is just reaching a stage really suitable for turkey range, (2) a lack of breeding stock over most of the area. It is believed that, once this large pine-hardwood forest area becomes mature and is placed on a rotational cutting basis, this general area will produce the greatest block of potential turkey range of any area in the State. (See Table 41-a for the potential range acreage by parishes.)

The present native turkey population in the Northwest Louisiana Uplands consists of some 15 widely scattered flocks or a total population of approximately 165 birds. To this, 251 pen-raised birds have been added since 1948. This barely constitutes a good breeding potential, particularly in view of the fact that the flocks are so widely scattered. An examination of Tables 41-a and b will show that the total potential range for this area is 2,003,000 acres. Using 1 bird to 475 acres as the average carrying capacity, a total population of 4,216 can be expected for the area.

There are several limiting factors in addition to those discussed above, which will have to be considered in the over-all management program for the area. The primary ones of these are open range grazing of hogs and cattle and illegal hunting.

Following are suggested recommendations for turkey management in the area:

1. Establish a series of fenced turkey management areas at strategic sites through the area. Areas containing native birds should be selected if possible.
2. Restock the management areas with native wild stock if possible, until the breeding potential is suitably high.
3. Remove all hogs and other livestock from management areas and try to educate the public toward removing them from the entire range.
4. Practice turkey management on all refuges and also on United States forest lands. This should include supplemental food plantings, preparation of forest openings, establishment of native grasses in the openings, and some predator control.
5. Maintain a closed season over the entire area until the population is high enough for hunting.
6. Direct a publicity and educational campaign toward creating an interested and cooperative attritude on the part of the general public.

THE SOUTHWEST LOUISIANA TERRACE LANDS (PINELANDS)

The Southwest Louisiana Terrace Lands, made up of all or parts of the parishes of Allen, Beauregard, Vernon, Sabine, Rapides, Calcasieu, and Evangeline comprise the only other area that can potentially support turkeys. At the time of this survey, there were only eleven native turkeys in the area, but 625 birds have been released throughout the area between 1948-50. The turkey map (Fig. 16) shows the general location of these releases and Tables 41-a and b show the number of released birds and the amount of potential range located in each parish.

The quality of turkey range throughout this ecological division is excellent and almost identical in type with the Southeast Louisiana Terrace Lands described above. Poorer soils in this area and extensive cut-over pineland do somewhat limit the extensiveness of range. For the most part, the mixed bottomland hardwoods and pine-hardwoods areas that are large enough to be suitable for turkeys are in general found in the larger river bottoms and "bays". The West Bay in Allen Parish and the lower Calcasieu and Whiskey Chitto bottoms are typical examples of the best turkey range in the area. A re-examination of the description of this ecological division (see ecological section) will indicate the basic plant types that are generally suitable for turkey in this area.

At the present time, except in restocked areas, there is no breeding population in this area. Potentially, this area could carry some 1395 turkeys on its 663,000 acres of suitable range. This estimate is based on the carrying capacity of similar range in other parts of the State. (Table 41-b)

In order to restore turkey to the Southwest Terrace Lands, a program of restocking, refuges, predator control, and management is necessary. Many of these steps are now in progress, but they should be expanded here as in all other areas. For specific recommendations, see those outlined for the Southeast Terrace Lands and the Northwest Uplands, which should also all be applied to this area.

CONCLUSION

From the findings on this investigation as well as the recent surveys by Bick (1942) and Hollis (1950) certain conclusions may be drawn about turkey conditions in Louisiana. In the first place, the present population even including recently released birds is at a critical low. Although many factors have operated against the turkey in the State, the basic cause for the general low population is a lack of range. This same factor will also operate against any management program. The total potential turkey range in the State is a little over 4,200,000 acres. This is roughly 25 per cent of all of the forest lands of the State and nearly 50 per cent of the operable timber. Only operable areas of forest are mature enough to support turkey. When the pure cut-over pine areas and young brushy second-growth forest are ruled out, 4,216,000 acres are about all that can possibly be found suitable for turkey range in the State. This is a maximum estimate. When this available range is re-examined in view of the critical requirements for good turkey range not much over 2,500,000 acres will be found to be suitable for extensive turkey management at the present time.

According to Mosby (1943), one turkey to 380 acres was a good average density on turkey ranges in Virginia. In Missouri, a density of one bird to 1020 acres was determined. Wheeler (1946) found an average density of 1 bird to 456 acres of range in Alabama. The findings of 1 bird to 450-500 acres of occupied range in Louisiana is within expected bounds, but applying this carrying capacity to the total available range allows a total expected potential for the State of between 8,000 and 9,000 birds. This estimated population is based on the maximum available range, an expected population of 5,000 would be more in line when all of the critical characteristics of turkey range are taken into consideration. An examination of Tables 41-a and b show that the present population of the State, including restocked birds, is between 3200 and 3800. This is more than 37 per cent of the expected potential population. It becomes obvious that lack of range in Louisiana will always keep its turkey population so low that it demands careful regulation of annual kill and necessitates constant supervision and management of as much of the range as possible. Under a good permanent management program, an annual kill of from 1,500 to 3,000 may be expected for the State.

The above conclusions are based on the analysis of field conditions over large areas by recognized management authorities in states where turkey are plentiful. On the other hand, other workers (Leopold, 1944 and Stoddard, 1935) have found that on small intensively managed areas a much higher carrying capacity, up to 1 bird to 25-40 acres, may be attained. If intensive management can eventually be applied to the many refuges and the bulk of the National Forest Lands in Louisiana, a considerably higher turkey population might eventually be expected.

Squirrels

GENERAL DESCRIPTION AND BIOLOGY

There are two species and five races of squirrels ranging throughout the State of Louisiana. The gray squirrel species consists of two races: *Sciurus carolinensis carolinensis* and *S. c. fuliginosus.* The three races of fox squirrel are *Sciurus niger bachmani, S. n. subauratus* and *S. n. ludovicianus.*

The gray squirrels are, in general, found over the entire State, but are largely confined to the bottomland hardwoods along streams and swamps. The two races are rather distinct in their distribution according to Lowery (1943). *Sciurus carolinensis carolinensis* is a lighter colored race found in the creek bottoms associated with the hill and terrace lands of the State while *S. c. fuliginosus* is a dark, almost brown, squirrel common in the lower Mississisppi alluvial plain.

The distribution of the fox squirrels over the State is even more distinct. According to Lowery and Davis (1942), one race of fox squirrel is confined to the Southeast Louisiana Terrace Lands or Florida Parishes (Fig. 18). This is *Sciurus niger bachmani*, a rather large, rusty colored squirrel with some black on the upper parts, in particular on the top of the head. The nose, ears, and toes are white and some individuals have the tail tipped with white. Occasional melanism occurs in this race. *S. n. subauratus* is a small, reddish, orange-bellied squirrel that occurs in bottomland areas throughout the state. *S. n. ludovicianus* is an extremely large, robust fox squirrel, grayish above, strongly suffused with black, buff and pinkish cinnamon below (Lowery 1942). It has an unusually large head and is distinct from the other fox squirrels in Louisiana both by its size and color. Its range is confined to the Northwest Louisiana Uplands and the Southwest Louisiana Terrace Lands. (See map—Fig. 18—for distribution of the various races.)

In considering the general biology of squirrels in Louisiana, it is only necessary to divide them into the fox and gray types. Henceforth, in this discussion, any references to fox squirrel will automatically mean that particular race in the area under discussion. The same will be true for the gray species. In speaking of the entire State, the various races of each species will be considered as a group.

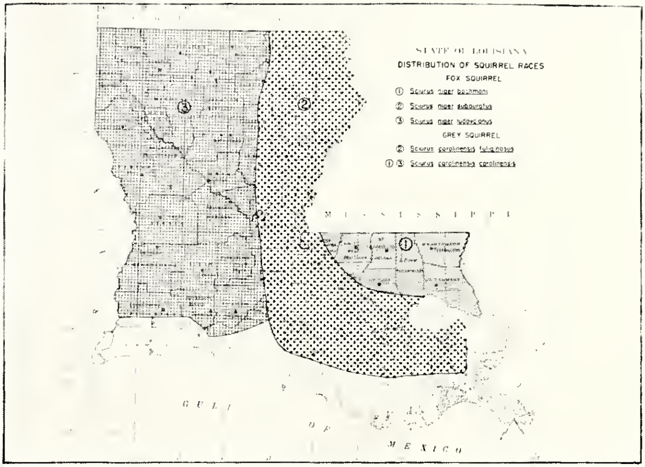
STATE OF LOUISIANA
DISTRIBUTION OF SQUIRREL RACES
FOX SQUIRREL
① Sciurus niger bachmani
② Sciurus niger subauratus
③ Sciurus niger ludovicianus
GREY SQUIRREL
② Sciurus carolinensis fuliginosus
① ③ Sciurus carolinensis carolinensis
③
②
①
MISSISSIPPI
GULF OF MEXICO

FIGURE 18.

Although the squirrel is probably the most hunted game animal in this State, as well as in many sections of the eastern U. S., little research has been done in this region on this important species. There is a particular lack of knowledge of squirrel conditions in the Gulf Coast States. Table 43 summarizes the generally known facts about the habits and basic ecology of the gray and fox squirrels of the eastern United States.

The information gathered on this Louisiana survey supplemented by reference to the work done by Bateman (1949) in Louisiana, by Goodrum (1937, 38, 40) in east Texas and Redmond (1950) in Mississippi would indicate that the ecology of squirrels in this general area closely follows the findings outlined in the above table. Slight differences in the time of breeding would be expected, and there is some evidence that population density may be, in general, slightly higher throughout much of the vast forested areas of some of these more southern states. Following in a general discussion of the inventory of squirrel conditions in Louisiana.

RANGES

Basically, squirrel can potentially occupy all forested areas in the State, with the exception of pure pine stands. To evaluate fully

TABLE 43

SUMMARY OF SOME ECOLOGICAL CHARACTERISTICS OF SQUIRRELS FOR EASTERN UNITED STATES

	GRAY SQUIRRELS	FOX SQUIRRELS
Type of Range Preferred	Bottomlands and wet swamp areas. Large blocks of forest of considerable density are the most desired type.	More open forest, forest edges near farms or prairies. Forests with openings. A good farm wood lot squirrel.
Breeding Habits	Produce two litters a year. Rutting and nursing from December to March and from June to October. No. of young per litter – 2-4, occasionally 6. Maternal care continues for 9 weeks after birth. Two types of nests—tree hollows or twig nests.	Produce 2 litters a year. Breed December to February, and June to October. No. of young per litter—3. Two types of nests—tree hollows and twig nests.
Movements	Normally do not move more than 200 yds. to ½ mile from nest.	Range restricted, rarely goes more than 200 yds. from nest.
Populations	Populations vary from high on mature mixed bottomland range to low in small hill creek bottoms. Investigations by numerous authorities indicate average density of from 2 squirrels to the acre on good range to as low as .23 squirrels to the acre on poor type of creek areas. This squirrel is not found in pure hill areas. Regardless of population density cyclic highs and lows occur annually from changes in food conditions and periodically a longer cycle occurs from unknown causes.	Like gray squirrels have higher populations on better range. In general, they are less numerous —1 fox for every 3 to 9 grays in Louisiana. Population density on occupied range runs from .51 to 1.36 squirrel per acre on selected wood lots but probably only .25 to .35 per acre on large areas. Cyclic highs and lows of population occur in the fox squirrel also.
Annual kill	May range from 30% to 50% of total population in heavily hunted areas.	Approximately 30% of population killed annually.

the squirrel potential of the State, the available range must be divided into various types according to its general productivity or carrying capacity.

There are 4 basic types of squirrel range in the State which are more or less characterized by the forest types present, the extent of forest in each range type, and the carrying capacity of the general food supply of each. These various squirrel ranges are shown in Fig. 19 and may be described as follows:

Range Type 1: A mixed bottomland hardwoods range primarily confined to the Upper and Lower Mississippi Alluvial Plain

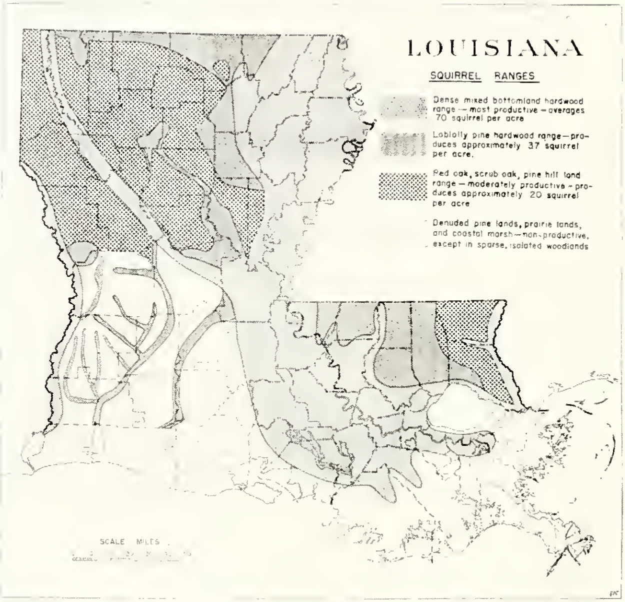
LOUISIANA
SQUIRREL RANGES
Dense mixed bottomland hardwood range — most productive — averages 70 squirrel per acre
Loblolly pine hardwood range — produces approximately 37 squirrel per acre.
Red oak, scrub oak, pine hill land range — moderately productive — produces approximately 20 squirrel per acre
Denuded pine lands, prairie lands, and coastal marsh — non-productive, except in sparse, isolated woodlands
SCALE MILES

FIGURE 19.

and to the alluvial plains of all other large rivers in the State, this area of approximately 5,500,000 acres is the best squirrel range in the State and is probably some of the best producing range in the United States. Here large, contiguous blocks of mixed hardwoods furnish ideal food and range conditions for the gray squirrel and one race of fox squirrel. This area probably carries more fox than gray squirrels. Four years of bag checks revealed that five fox squirrels were killed for each four grays bagged.*

Range Type 2: This consists of some 4,000,000 acres of loblolly pine-hardwoods and mixed creek bottom hardwoods. The bulk of this area is depicted on the range map (Fig. 19) but it also includes many areas too small to map, such as pine-hardwoods and creek bottom hardwoods along the smaller streams in the pine areas. This is, in general, an excellent squirrel area, but possibly because of the configuration of forest in narrow strips along the streams, somewhat less food by volume, and the fact that the fox-gray ratio is different, there is apparently not quite as high a carrying capacity as in Range Type 1.

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* From P-R Project 27-R.

Range Type 3: This area (Fig. 19) is confined to Northwest Louisiana. It consists of some 2,300,000 acres of second-growth pine forest that is fairly well mixed with scrub oaks and southern red oaks. There are few areas of solid pine and, in most places, enough hardwoods occur on the hills to afford some carrying capacity for squirrel. The carrying capacity here is, of course, lower than in types 1 and 2. Approximately 350,000 acres of this type range is denuded and for all practical purposes has no carrying capacity.

Range Type 4: This range includes the remainder of the forested areas of the State. In it there are some 3,180,000 acres of cut-over and denuded longleaf and slash pinelands in the Southeast and Southwest Louisiana Terraces, all of the prairie lands, and the coastal marsh. Generally, this type range is non-productive of squirrels. Squirrels do occur in all of the ecological divisions included here, but they are in general confined to the creek bottoms and pine-hardwoods areas of range types 1 and 2 which also occur to a very limited extent in these sections (see map, Fig. 19). Occasionally, squirrel may be seen in longleaf pine areas but they do not use the area the year-round nor are they likely to be present in any numbers on cut-over pine barrens, in pure dense stands of planted pine, or in the coastal marsh proper. In summation, the total squirrel range in the State consists of three productive types of range encompassing some 11,800,000 acres. A fourth type of range is practically nonproductive—Table 45.

Foods Utilized by Squirrel

There is a wide variety of foods suitable for squirrel throughout the forested areas of Louisiana. Practically all mast, seed, and fruit producing trees, shrubs, and vines as well as many types of buds are utilized. These, in general, include most of the oaks, beeches, magnolias, gums, dogwoods, hickories, pecans, wild fruits, and berries. A list of the plant species in the various ecological sections may be consulted for a more detailed list of the available plants. (Tables 6, 9, 12, 15 and 18)

There is no lack of variety in Louisiana of plants suitable for squirrel foods, but there are certain controlling factors which limit the carrying capacity of the various areas. One of these is the quantity of food produced. Best mast production is reported to take place in middle-aged to old stands of forest. Young forests, or areas where the old trees have been removed for lumber, produce a smaller volume of food and, therefore, fewer squirrels. Another very important factor is a year-round food supply. Most areas produce well in the fall and early winter months but do not furnish enough foods in summer. Bateman (1949) studied squirrel feeding habits in the southeast Terrace Lands over a period of several years. Table 44 shows some of his findings regarding the utilization of various plants by squirrel at various times of the year. A study of these findings indicates that summer foods are less available than the winter foods both in number of species and by volume. It will be noted that most of the summer foods consist of fruits and berries which occur for only short periods and at different times. This is probably the period of the year which controls the over-all carrying capacity of a range. Since fruit and berry producing plants are usually sub-dominant types, they are widely and sparsely scattered throughout the forest and along edges. This causes a scattering of the summer squirrel population. The fall and winter foods are more likely to be concentrated in more circumscribed areas and results in considerable fall concentration of squirrel populations. Such concentrations may be highly localized and are not likely to be marked unless populations are high.

In general, squirrel food conditions in the forest areas of the State are good and are improving as areas become reforested and older. Conditions in local areas fluctuate with weather conditions and timber operations, but this is to be expected.

Population and Annual Kill

Any attempt to determine the exact squirrel populations of an area as large as a state would involve an almost insurmountable manpower and time factor and the result obtained would still be questionable.

The other approach to this problem is to make an estimate that is based on the information obtainable at the time and that

TABLE 44

SEASONAL UTILIZATION OF FOODS BY SQUIRREL[1]

FALL AND WINTER MONTHS	SPRING AND SUMMER MONTHS
Beech _(Fagus grandifolia)_*	Blackberry _(Rubus_ spp.)
Blackgum _(Nyssa sylvatica)_*	Cherry _(Prunus_ spp.)
Chinquapin _(Castanea pumila)_	Dewberry _(Rubus_ spp.)
Cypress _(Taxodium distichum)_	Fringetree _(Chionanthus virginicus)_
Dogwood _(Cornus florida)_	Grape, Summer _(Vitis_ spp.)
Elms _(Buds) (Ulmus_ spp.)	Blackgum _(Nyssa sylvatica)_
Grape, Winter _(Vitis_ spp.)	Tupelo Gum _(Nyssa aquatica)_
Hickory _(Carya_ spp.)*	Hickory _(Carya_ spp.)*
Hornbeam _(Carpinus caroliniana)_*	Hornbeam _(Carpinus caroliniana)_
Hophornbeam _(Ostyra virginiana)_*	Hophornbeam _(Ostyra virginiana)_
Magnolia _(Magnolia grandiflora)_*	Huckleberry _(Gaylussacia_ spp.)
Oak, Water _(Quercus nigra)_*	Mayhaw** _(Crataegus opaca)_
Oak, Red _(Quercus falcata)_*	Muscadine _(Vitis_ spp.)
Oak, White _(Quercus alba)_*	Mulberry** _(Morus rubra)_
Oak _(Quercus_ spp.)*	Magnolia _(Magnolia grandiflora)_*
Pecan _(Carya pecan)_*	Pine _(Pinus_ spp.)
Red Gum (Fruit & Buds) _(Liquidambar styraciflua)_	
Silverbell** _(Halesia diptera)_	
Sourwood _(Oxydendrum arboreum)_	
Winterhuckleberry _(Vaccinium arboreum)_	

* Used for six or more months out of the year. Definitely a staple food.

** Used heavily in short fruiting season.

[1] Modified from Bateman's findings.

may be revised as new findings occur. In this study, the latter method has been utilized and an estimate has been made after a study of the findings of various authorities have been evaluated in the light of range conditions in Louisiana and a limited amount of research carried out on this study. Table 45 summarizes the results of the study. In making this estimate, the range types were divided according to their relative productivity as described above. The amount of each range is the nearest round figure to the total acreage of such type after denuded areas and young second-growth has been deducted as nonproductive. A range of population densities was determined for each type range from the findings of various authorities and from work on this project. From these figures the estimated average population density was set near the lower limits of the range so that a conservative estimate would result. In this manner, it was found that some 11,800,000 acres of productive range produces an estimated average of 5,790,000 squirrel at the fall peak population period. This

TABLE 45

SUMMARY OF SQUIRREL INVENTORY DATA

Range Type No.	General Characteristics of Range**	Approx. Total Acreage	Range of Reported Population Density Squirrels/Acre	Average Population Density in Squirrels/Acre	Total Population
1.	Mixed bottomland hardwoods, large blocks of forest, dense, and much of it wet. Confined to large river alluvial plains	5,500,000	.80-2.00/A[2] .50-1.00/A[3] .51-1.36/A[4]	.70/A*	3,850,000
2.	Pine-hardwood and creek bottomland-hardwood areas. Few large areas (see map) primarily along smaller waterways and creeks in pine hill areas	4,000,000	.23-1.72/A[1] .50/A[2] .20- .50/A[3]	.37/A*	1,480,000
3.	Primarily pine and scrub oak, some red oak and associated types. Hill tops and higher areas of Northwest Louisiana Uplands	2,300,000	0.00- 50/A[1] [3]	.20/A*	460,000
4.	Denuded pine lands, planted pure pine stands, prairie and marsh lands	3,180,000	0.000	0.00	....
	TOTAL	11,800,000***			5,790,000

[1] From Redmond's findings in Mississippi.
[2] From Goodrum's findings in East Texas.
[3] Special studies on this project.
[4] Baumgartner's findings in Ohio.
* The best adjudged average from all sources considering range conditions in Louisiana.
** See range type map (Fig. 59) for location of these areas.
*** Represents total of only the productive range. Unproductive 3,180,00 acres omitted.

figure, of course, can and does fluctuate from year to year probably varying between a low of 4,000,000 and a high of 8,000,000 depending on food. disease, weather, and other factors controlling populations.

In attempting to determine the annual kill in Louisiana, there are at this time, no records upon which reasonably accurate estimates may be based. No attempt has ever been made to establish a tag system or to index the hunters in the State. Without such information, only a general estimate can be made as follows: by interviews with random license holders and game wardens, it is apparent that at least 90 per cent of Louisiana's 200,000 license holders hunt squirrel at some time during the season. Random interviews with over 300 hunters in the better squirrel areas indicate that the annual kill per hunter ranges from five to well over a hundred per person. The average per hunter is approximately 20 per season. These figures are from the bottomland areas where squirrel populations are high. It might be immediately assumed that in areas of lower density this average kill would fall off. This, however, may not be the case because in such areas dog hunting is more common, resulting in a much higher kill. The following table shows the average kills from various areas and various authorities as compared to the finding on this survey.

It is seen from various authorities that an average annual kill of 10 or more squirrels per hunter is not exceptional. In Louisiana where there is a predominance of squirrel hunters, a high squirrel population, and a considerable disregard for the squirrel season, it is believed an estimated 15 squirrels per hunter per season is conservative. Using 15 for the average kill, the total kill for the State is between 1,900,000 and 2,700,000 annually.

It is evident from this study that squirrel populations are high in Louisiana, but the heavy annual kill more than offsets the high population. The condition is apparently stable, however, since no marked changes in squirrel populations have occurred during this study nor have any been reported in recent years. In general, changes in squirrel conditions and populations are so gradual that a more frequent and more accurate way of inventory would have to be used in order to determine the change.

TABLE 46
SQUIRREL KILL DATA

AREA	AUTHORITY	NO. HUNTERS STUDIED	AVG. ANN. KILL HUNTER	REMARKS
OHIO	Baumgartner	....	8.0-9.0	In good seasons
MICHIGAN	Allen	....	10.6	Based on kill of 30% of total population adjusted to 180,000 Louisiana hunters.
MISSISSIPPI	Freemen	136,280	5.7	Quoted by Redmond (1950)
LOUISIANA	U.S. F & WS 1943	438	35.0	From random interviews
LOUISIANA	This study	300	20.0	Interviews in best areas only.
LOUISIANA	Pittman-Robertson Project 27-R*	1,352	13.98	1953-54 Season.
	Pittman-Robertson Project FW-IR*	3,453	15.35	1953-54 Season. Questionnaires from this project revealed that 53% of hunters in this state are squirrel hunters.

LIMITING FACTORS AND RECOMMENDATIONS

The limiting factors which probably do most toward controlling squirrel populations in Louisiana may be enumerated as follows:

1. *Food Limitations:* This may be of several causes, some of which are controllable. There is a loss of mature, mast producing trees by cutting, elimination of all mast producers in pine areas by timber stand improvement practices, and the loss of mast on the ground to free-ranging hogs.
2. *Loss of range and den trees:* The clearing of land for farms and the practice of the removal of all "wolf trees" in the interest of better stands of merchantable timber are lowering the squirrel population in some areas by an actual reduction in range and den trees.

Squirrels are prolific breeders and, apparently, because of this they have been able to maintain a fairly stable population in the face of the heavy hunting pressure in the State. It has been demonstrated by Goodrum (1937) in east Texas that both fox and gray squirrel breed twice a year. This is fully substantiated by observations made in Louisiana. The summer breeding season shows young being dropped and suckled from June to October 15. (Our fieldmen observed two litters with eyes still closed during the first week of September. Certainly, these young will be dependent on the mother well through the month of September and most of October. Many females killed even in late October are still suckling their young.) However, breeding animals have been found every month of the year.

The winter breeding season begins with rutting in late December and early January with a majority of the females carrying young in late December, January, and February. Evidence is cited by Goodrum (1937) that probably the winter season is the heaviest and most important in maintaining a good population.

General recommendations for improving squirrel conditions in the State are suggested as follows:

1. Hunting pressure should be better controlled so that too high a kill would not occur, particularly during the breeding season. Such a course would entail devising some system of hunter bag checks, indexing of hunters as to number and areas hunted, adjusting hunting seasons to protect breeding squirrels, and strictly enforcing the season.
2. Range conditions could be improved by preventing damage by timber operations and practices. Admittedly, there will be conflict between the end results desired by forestry technicians and game technicians, but private owners who want more game could be taught how to save den trees and rotate for a greater percentage of older mast producing trees. All national and state forests are considered recreational areas and therefore game conditions should be given equal emphasis with forestry practice. If such were the case, timber stand improvement practices and timber cutting practices should be designed to give game a high chance of survival.
3. The practice of open range grazing by hogs and cattle throughout most of the forests of Louisiana will have to be eliminated before maximum squirrel or any maximum game production can be expected. It is not the intention here to demand such a change since many factors and individuals are involved, but it should be made clear to all concerned that this change is necessary to obtain the best game conditions for the State.

Squirrel Conditions in the Various Ecological Divisions of the State

It has been the practice thus far in the report to discuss the condition of each species in each ecological division with appropriate recommendations for each. An examination of the map (Fig. 19) will show that the various types of squirrel range, particularly Type 2 is found in most of the ecological divisions. To avoid repetition, a slightly different approach to the discussion of squirrel conditions on the various range types of the State is used here. Table 47 lists the parishes of the State according to their range, their ability to produce squirrels, and to withstand hunting pressure.

In the above table, Column I lists those parishes in which the squirrel range is extensive and the population high. These parishes are primarily in the bottomland hardwood sections and the vast wooded areas are a protection for squirrel. Heavy kills are coming from these parishes annually without any demonstrable damage to the squirrel population and it is doubtful whether the present hunting pressure will severely damage these areas.

In Column II, the parishes listed have a good productive type of squirrel range, with a moderate population density per unit area. The over-all acreage of range is somewhat limited and this, when coupled with moderate densities, limits the total squirrel population in these areas. Heavy hunting pressure in these parishes is marked by a decline in the shootable population before the end of the season so that hunting becomes difficult without dogs some 30 or more days before the end of the season. In cases where illegal hunting is heavy before the season, a good season is not had by the legal hunters in the area.

Column III: This group of parishes has an excellent but quite limited type of squirrel range which is almost entirely confined to relatively narrow creek and river bottom areas because the remaining areas are either extensively farmed or cut-over. The over-all population here is necessarily limited because of the limited range. In such areas heavy hunting pressure or early season illegal kills may lower the population in 30 days' time to such a point that it is unprofitable to hunt without dogs or in some cases to hunt at all. Heavy illegal pre-season hunting in some areas leaves few squirrel for the legal hunter to bag.

TABLE 47

PARISHES LISTED ACCORDING TO DENSITY OF SQUIRREL POPULATION AND EXTENSIVENESS OF RANGE

Heavy Squirrel Population (Col. I)	Intermediate (Col. II)	Low (Col. III)	Coastal Marshes (Col. IV)
East Carroll	Union	Caddo	Cameron
Madison	Morehouse	Bossier	Vermilion
Tensas	Franklin	Webster	St. Mary
Concordia	Caldwell	Claiborne	Terrebonne
St. Landry	Catahoula	West Carroll	Iberia
Pointe Coupee	Winn	Richland	Lafourche
Avoyelles	Jackson	Ouachita	Jefferson
West Feliciana	DeSoto	Lincoln	Plaquemines
East Feliciana	Sabine*	Bienville	St. Bernard
East Baton Rouge	Natchitoches	Red River	Orleans
St. Helena	Rapides	Vernon*	
Ascension	Tangipahoa	Allen	
St. James	Washington	Beauregard*	
St. John the Baptist	St. Tammany	Calcasieu	
Livingston	Grant	Jefferson Davis	
St. Martin	LaSalle	Acadia	
Iberville	Evangeline	Lafayette	
Assumption			
West Baton Rouge			
St. Charles			

Column I: Primarily bottomland hardwood areas, extensive range, good population and plenty of natural protection for squirrel.

Column II: Mixed hardwoods and pine-hardwoods or second-growth areas, intermediate amount of range.

Column III: Parishes with vast cut-over or farmed areas. Squirrel range confined to narrow creek bottoms.

Column IV: Coastal Marshes. Excellent population where range exists. Range is limited in many parishes.

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* Excepting Sabine River Bottom.

Column IV: The coastal marsh parishes have not been studied to any extent but those which have squirrel ranges are similar to the Column I group, since available bottomland hardwood areas along the coast are usually highly productive.

The parishes as listed in Table 47 are shown on the map (Fig. 19). A Comparison of this map to the forest type map and to the map of ecological divisions (Figs. 11 and 12) will show that the best squirrel areas are in the bottomlands of the Upper and Lower Mississippi Alluvial Plain ecological divisions. The intermediate type range is confined primarily to those parts of the northwest upland and the southeast and southwest terrace lands that have extensive pine-hardwood or pine-scrub oak forests. The low-producing areas are those parts of these same divisions where forest range is sparse because of extensive denuded pine areas or because of extensive farming.

Recommendations for the entire State have been listed above. Such recommendations are particularly necessary in those areas listed in Column II and III of Table 47. Pre-season kills, elimination of scrub oaks and den trees by timber stand improvement, and free-ranging hogs are all particularly detrimental to squirrel in these parishes.

AMERICAN WOODCOCK

The woodcock (*Philohela minor*) is primarily a woodland occupant which is a winter visitor to Louisiana. It is a much-prized game bird in many parts of the United States, but although Louisiana is believed to be the center of the wintering ground for this species, it does not rank as a major game bird of the State.

Careful research and study on this species has been neglected for many years and only recently has any considerable amount of work been done. Most of the work has been accomplished in the northern breeding areas, but since 1947, Prof. L. L. Glasgow has been doing intensive work on the woodcock in and around the Baton Rouge area in Louisiana. The writer is much indebted to him for considerable information gained via personal communication.

The work on this project concerning woodcock has involved a study of its general movements and habits in Louisiana, the major flight arrivals and departures, trends in populations and population distribution, and methods of hunting.

LIFE HISTORY, ECOLOGY, GENERAL CONDITIONS

Although the woodcock is a winter visitor to Louisiana, Lowery (1950) indicates that sight records of it are available for each month during the year except August and September. It is probable that some birds are to be found in Louisiana throughout the entire year. The bulk of the winter population, however, arrives in the State after December 15 and is usually gone by the middle of February. Some breeding is known to occur in Louisiana, but it is not believed to be of significance. The bulk of the national population breeds in the northeastern United States and in Canada.

The woodcock is chiefly a nocturnal bird feeding in pastures

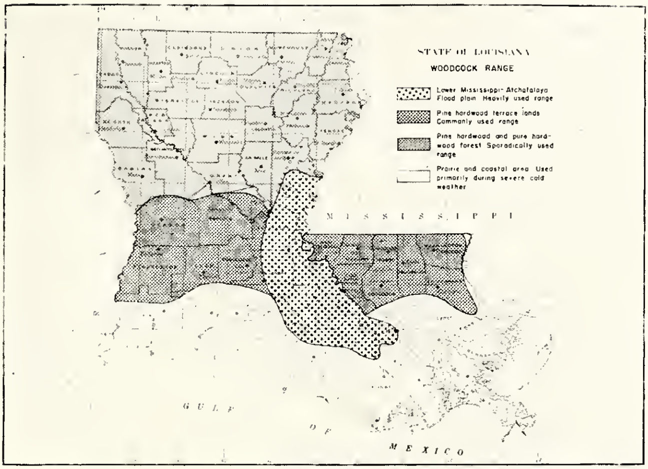

STATE OF LOUISIANA
WOODCOCK RANGE
Lower Mississippi-Atchafalaya Flood plain Heavily used range
Pine hardwood terrace lands Commonly used range
Pine hardwood and pure hardwood forest Sporadically used range
Prairie and coastal area Used primarily during severe cold weather
MISSISSIPPI
GULF OF MEXICO

FIGURE 20.

and open woods and fields at night and resting or feeding in thick, brushy cover during the day. Its food consists of 95 per cent animal matter, most of which is earthworms. It feeds by probing with its long, slender, delicate bill into moist ground. The fact that the woodcock feeds in this manner makes the availability of its food subject to various conditions not necessarily affecting other types of game birds. Good feeding areas may become useless as they dry up and get too hard for probing. Frozen earth prevents feeding. Low, wet, wooded areas are definitely necessary for high woodcock populations as well as open fields or burned areas where they feed at night. All of these factors tend to control woodcock movements and populations. Following is a discussion of woodcock conditions in Louisiana as determined by this investigation.

General Range:

The general winter range of the woodcock in Louisiana includes the entire State with the possible exception of the coastal marshes. The actual distribution of birds over the range varies considerably, resulting in four major areas which show a different degree of utilization by the wintering population in the State. (See map-Fig. 20). The exact causes for this difference in the degree of utilization of various sections of the State have not been specifically determined. The areas are described below with a discussion of the factors that might be involved.

Lower Mississipi Atchafalaya Basin Area:

This area, including the parishes of St. Landry, Iberville, Pointe Coupee, West Baton Rouge, and possibly south to St. Martin, Iberia, and north into Concordia and Tensas Parishes, is the range in Louisiana most preferred by woodcock. In this area, the birds use the low, damp, dense, brushy, second-growth bottomland hardwoods for daytime cover and come out by the hundreds to feed in open pasture and farmlands at night. The exact reason for their preference of this area is not clear. Although it is ideal woodcock range with damp wooded thickets, moist rich soils, and ample cover and food, there are other areas along the coast to the east and west of this section that appear the same yet do not attract woodcock in any quantity.

Southeast and Southwest Terrace Lands

The cut-over and lightly reforested pine lands interlaced with small wooded creeks and "green heads" so characteristic of the southeast and southwest terraces are the second most-used woodcock range. In these areas the constantly flowing creeks and spring heads covered with thickets of bay, myrtle and alder firm an ideal daytime feeding and cover area. At night, the bare pine hills and burned grass lands furnish feeding grounds. When flights of woodcock are in the area, they may be flushed along the brushy draws in considerable numbers.

Northwest Louisiana Uplands and Upper Mississippi Alluvial Plain

Woodcock were not reported as occurring generally over the northern part of the State, but there is some evidence that small concentrations occur widely scattered over the area. There are reasons why some parts of north Louisiana might not support large bird populations but none of the factors seem to hold for the entire area. For example, it is generally true that the poorer, better drained soils of the northwest pinelands might not furnish large blocks of good range in any one spot, but the over-all total amount of damp bottomlands along creeks should be of considerable significance. The Upper Mississippi Alluvial Plain portion of this range is similar in many respects to that in the Lower Mississippi, yet a much smaller segment of the population seems to occur here than in the southern section. Weather might be a factor at times. Frozen ground occurs in north Louisiana much more frequently than in the southern part, yet there are still many more warm days than cold in the area. The factors operating toward limiting the use of the northern section of the State by woodcock may be summarized in part to include poorer soils, fewer moist areas, and cold weather.

The Prairie and Coastal Marshes

In the extreme southern part of the State, as well as in the north, woodcock are sparse, but there seems to be more justification for this condition in the south than in the north. In this section, vast areas of coastal marsh offer no cover or suitable areas for the woodcock. The fringing areas of higher land are excellent range for woodcock, but limited. There is a decided shortage of cover throughout most of this area and particularly in the southwest prairie lands. This, no doubt, is the main limiting factor to great use of the area by the woodcock. At times when extremely cold weather freezes the soil in other sections of the State, birds are forced into this prairie and coastal area by the thousands where they utilize every available copse of wood or cover.

Flights, Population, Density and Distribution:

The presence of the bulk of the winter woodcock population in Louisiana, as in the case of all migratory birds, is dependent upon the arrival of periodic flights. These major flights may occur at any time after December 15, but they are highly sporadic. Presumably, early and continued cold will drive the birds down by December, but this is not necessarily the case and in instances where early blizzards hit north of this area many woodcock are killed. Once the flights start, cold spells seem to drive the birds down while warm dry periods result in a decline.

The period between flights and the local movements of birds present the most difficult part of the woodcock picture to analyze. Between flights, birds may virtually disappear from whole sections. There is some evidence that because of excellent food and range conditions their presence may be a little more stable in the Lower Mississippi-Atchafalaya area, but even here a minimal disturbance of an area will cause them to move and the area stays empty, presumably until new birds arrive. Professor Glasgow of Louisiana State University has found this to be generally true from his banding activities in the Baton Rouge area. There seems to be no clear answer as to where and why the birds move. It seems that because of disturbance or in order to find better feeding conditions large segments of the population will move from one area to another. This would indicate that the total population in the State is relatively small and concentrated in segments which move from feeding area to feeding area as weather and other conditions force them.

On the other hand, there is some evidence that this may not be the entire explanation. Professor Glasgow has evidence showing that banded birds tend to return to or very near to the same area from year to year. Furthermore, it is true that when large flights arrive in the State ahead of a cold wave, the birds usually appear in all sections at the same time. For example, Federal Aid personnel in the southwest terrace lands, Professor Glasgow in the Baton Rouge area, and investigators in the southeast terrace lands have observed the arrival of large flights in the entire southern half of the State occurring within a 48-hour period. It is evident that much more investigation is needed in order to clarify fully the woodcock flight patterns and movements in the State.

Even less is known about the number of birds wintering in the State. Studies of band returns and of the occurence of winter populations by various investigators indicate that the bulk of the national population winters in western Mississippi, Louisiana, and east Texas. Local studies and information obtained from Texas and Mississippi seem to indicate that most of the birds are in Louisiana.

Population estimates are not possible without much more work. Certain indexes or estimates of population may be considered. Professor Glasgow and his banding teams have flushed between 100-150 from fields and pastures on good woodcock nights. This represents the work of four men or approximately 16-20 man-hours of observation or a rate of from 4 to 6 birds per hour. Perkins et al, working on quail and woodcock, have made some interesting observations in the southwest pinelands. The following table summarizes their data.

TABLE 48
QUAIL-WOODCOCK RATIO

Hours hunted	Quail seen	Woodcock seen	Ratio quail/woodcock	No. Woodcock seen/hr.
198	788	127	6.2:1.0	.64

The above figures are based on 198 hunting-hours which is primarily the time that two bird dogs have worked in the field. The individual dog hours would, of course, be 396. In the western cut-over pine areas, both woodcock and quail are confined to or very near narrow wooded draws and scrub oak flats because such areas are the primary source of food and cover for them. Since these two species use the same range, they may be hunted at the same time. The woodcock seen per hour hunted and the ratio of 6.2 quail seen per woodcock is believed to be a fair index of population in this type area. If these figures are accepted, they may be used further to estimate the woodcock population in the southwest Louisiana terrace or pinelands. A careful census of quail taken over several years in this same area by using dogs and by walking strips indicates that the average over-all quail population is 1 bird in 30 acres. The quail:woodcock ratio of 6.2:1.0 would indicate approximately one woodcock for ever 186 acres or a total population of some 10,000 to 12,000 birds on some 2,000,000 acres of area in the southwest terrace lands. It is realized that this population estimate is subject to question, yet it represents the best figure obtainable that is based on observations and counts. This estimate of 10,000 to 12,000 woodcock is confined to that segment of the population using southwest Louisiana. Presumably, more birds than this occur in the Mississippi Alluvial Plain and a like number may occur on similar areas in the southeast pineland. Taking everything into consideration, a rough estimate of the total population wintering in Louisiana can be set between 100,000 and 200,000.

ANNUAL KILL, METHODS OF HUNTING, RECOMMENDATIONS

No definite figures on annual kill were obtainable. Perkins et al along with the above cited observations found that 1.3 woodcock were killed for every 4.66 hours hunted in the southwest pinelands. This rate of kill can only be applied in the cut-over pinelands and represented the average daily kill incidental to quail hunting made by two men and two dogs. No doubt more woodcock could be taken if they were specifically hunted, but woodcock hunting is not generally practiced in the State. There is no way to convert the quail-woodcock ratio into total kill because information as to total hunters or total quail killed in the area is lacking but general observations would indicate that the total is not too high.

In general, all evidence points to the legal kill in Louisiana being small, very few people hunt woodcock except as a supplement to quail hunting. This type of hunting occurs primarily in the pinelands. Little or no legal woodcock hunting occurs in the bottomland areas. Illegal kills by night hunting is another story. All indications are that many hundreds of birds are taken this way. No definite figures can be stated, but frequent reports indicate that individual hunters may take from 25 to 100 birds in a single night. How many such hunters there are and how often they hunt is not known. The reason for such night hunting is said to be the thick cover and hence the inability to take birds legally. Sucessful legal kills can be made in the thicker bottomland areas using good dogs and every effort should be made to educate the public to this fact. Sheer enforcement of law will not change what is considered a specific sport of long-standing by local people nor is it possible to maintain enforcement without high penalties and many officers.

Since the woodcock is a migrant, little can be done to manage this bird in Louisiana. On the other hand, the center of the national population winters in this area and a definite effort should be made to protect these birds from illegal hunting, while at the same time endeavering, to educate the hunters of Louisiana toward adding this fine game bird to their bag more often. It is believed that the most immediate needs for the betterment of woodcock in Louisiana at the present time are: (1) greater protection against illegal hunting and (2) considerably more research concerning flight patterns, population, and annual kills. This type of investigation should be carried out so that better seasons and bag limits may be set and an intelligent approach be made toward advising the public about when, where, and how to hunt the woodcock.

LARGE GAME AND FOREST PREDATORS

According to early historical writers and naturalists, there are several species of big game and various forest-residing predators which were present in what is now the State of Louisiana. These animals included the cougar, black bear, wolf, bobcat or lynx, and fox. Elk were of doubtful existence within the present state boundaries and buffalo, although present in the state, were more or less confined to the open grasslands and open forests. Many of these animals are now absent or rare in the State and are of little significance as far as huntable game is concerned. On the other hand, to have a complete record of game in the State, each species will be briefly discussed below.

ELK & BUFFALO

The American elk (*Cervus canadensis*) and the buffalo (*Bison bison*) were both reported in Louisiana by early travelers. Few writers mention the elk and those that did traveled widely so it is possible that this species never ranged into the present boundaries of the State. Anthony (1935) states that the original range of the elk was between the thirty-fifth and fiftieth parallels. The northern boundary of the State is along the thirty-third parallel or slightly south of the original range. Since DuPratz (1758) in his writings mentions the elk as being in the heavier forests of the high lands of Louisiana it is possible that a few did occur in north Louisiana. At the present time, there are no elk in the State although a few were stocked near Urania, Louisiana, between 1915 and 1920. The initial stock soon died out without establishing a herd.

There is considerable evidence that the buffalo at one time ranged throughout most of Louisiana except in the thick river-bottom forest lands. Lowery (1943) lists the bison in his check list of Louisiana mammals and substantiates his listing with numerous literature references. DuPratz (1758), Arthur (1931), and many others have reported at great length on the use of this animal for food and clothing by Indians and early settlers.

Original Range:

The exact range of the buffalo in the State is not clear. The writings are somewhat conflicting. There are ample reports which indicate that this species ranged over most of the State and even occurred east of the Mississippi River as far south as New Orleans and Plaquemines Parishes. This is evidenced by the Bayou Terre au Boeuf section of these parishes which is so named because it was wintering range for the bison in that area (Lowery 1943). On the other hand, other reports indicate that the bison shunned the thick dense woods along the Mississippi and other large rivers. Since this is true, it is not clear how they crossed to the east side of the River unless they ranged down from a herd that crossed much farther north. As far as Louisiana proper is concerned, there is no doubt that the bulk of the herds were west of the River. Only the very earliest writings report bison east of the Mississippi River while they were taken west of the River until 1800. Lowery (1943) reports that the last one killed in the State was near the present town of Monroe in 1803.

COUGAR

The cougar (*Felis concolor coryi*) is the rarest of the large forest animals still in existence in Louisiana. This large cat, peculiarily enough, has always been reported rare. The earlier writers report panther or cougar to be rare or always just in the next, deeper, and more uninhabitable woods. This is true in later writings also. Kopman (1921) reports that the few cougar remaining in the State at that time were confined to thick river bottom forests and canebrakes along the Black, Tensas, and Ouachita Rivers. Lowery (1943) reports them from the same general region some 23 years later with one additional sight record in Natchitoches Parish. Findings on this study are approximately the same as earlier findings.

RANGE:

There is little doubt that some cougar still exist in the State. Signs and regular reports of a few in the Tensas-Madison area and the discovery of tracks on the Red Dirt Game Management Area in Natchitoches Parish in 1949-50 make it clear that the species is still present. A careful sifting of reports would indicate that the few left in the State range between the Tensas-Madison area and Natchitoches Parish in the large belt of timber across the central part of Louisiana (See map-Fig. 21). In this area, there is ample isolation and enough food consisting of free-ranging hogs, calves, and possibly a few deer. Lowery and others report the presence of cougar in the Lower Mississippi-Atchafalaya

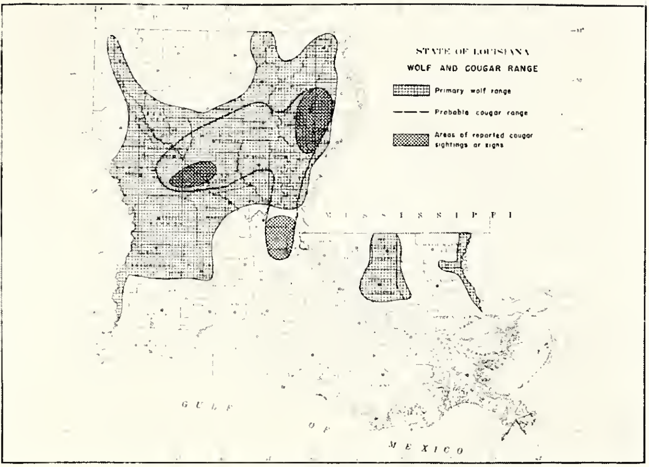


FIGURE 21.

Flood Plain particularly in the vicinity of St. Landry Parish. This survey was able to secure only one report of a cougar in this area. The bottom lands of the Atchafalaya are extensive and isolated and could well support cougar, but the annual high waters may in some way control their range in this area. The daily range of one of these animals may be as great as 50 miles. This being the case, some of the animals even though they are few in number, might be found in almost any part of the large contiguous forest areas in the State at some time or other during the year.

Population, Kill, Breeding

The total number of cougar in the State is not definitely known. It is believed that not more than 10 are present throughout the entire area, although the number might be smaller than this considering their ability to range over many miles. The peculiar part of the cougar picture is that none have been reported killed in many years, yet there seems to be no significant increase in population. It was assumed that breeding must occur or the species would now be gone from the State. Final proof of breeding was established in 1950 when tracks of one old female and two young were seen on the Red Dirt Refuge. With proof of breeding established and no kills made, there seems to be no satisfactory explanation of the failure of this animal to increase in numbers. Ranges and food are on the increase with successful reforestation and an increase in free-ranging hogs and cattle. Deer are also becoming more prevalent. The wariness of this animal might prevent an accurate estimate, and there may be considerably more of these animals present than have been reported. The fact that even the earliest writers reported it rare would tend to bear this out. On the other hand, there can hardly be any very large number in the State because no reports of predation from this species have been received.

BLACK BEAR

The Louisiana black bear (*Euarctos luteolus*) is another rare species of large forest game in the State although not so rare as the cougar. Records and reports on the bear are considerably more plentiful than for the cougar, although the two co-existed on virtually the same range in the past 50 years.

Past and Present Ranges of the Bear in Louisiana:

According to Lowery (1934), bears ranged extensively over most of Louisiana. DuPratz (1750) indicates that they were more or less confined to thick canebrakes of the hardwood forest in the Mississippi and Atchafalaya Alluvial Plains. It is quite probable that a few bear were found in the thicker wooded areas and river bottoms over most of the State, but records show that the majority of bears did occur in the Mississippi-Atchafalaya region. A record of the parishes containing bears in 1890 shows 17 to be inhabited—all of them in the Mississippi-Atchafalaya region. (Table 24). Kopman (1921) states, "The greatest number are found in the denser woodland along the Tensas, Red, Black, and Atchafalaya Rivers, though there is hardly an extensive area of lowland woods in the state that does not harbor at least a few bears." The present occupied range is now, as then, in the Tensas-Madison area in northeast Louisiana and in the lower fringes of the Atchafalaya basin (See map-Fig. 22). It would seem evident from this that bear in Louisiana always have been primarily bottomland hardwoods dwellers, requiring dense, remote canebrakes to reach peak populations. The Map (Fig. 22) shows the past and present range of the bear in Louisiana.

Present Population, Annual Kill and Status as a Game Animal:

The present bear population in Louisiana is sparse. An estimated

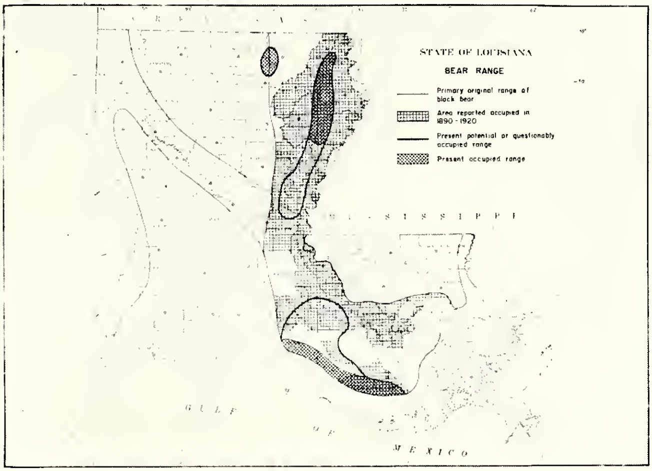

STATE OF LOUISIANA
BEAR RANGE
Primary original range of black bear
Area reported occupied in 1890 - 1920
Present potential or questionably occupied range
Present occupied range
MISSISSIPPI
GULF OF MEXICO

FIGURE 22.

80 to 120 have been located by cross-checking reports and interviews with woodsmen in areas where bear are prevalent. In general, the present population is about equally divided between the lower fringes of the Atchafalaya swamp along the marsh and the denser forest of the Upper Mississippi Alluvial Plain (Map-Fig. 21). Isolated reports of one or two bear have come from the Union-Morehouse area. It is not believed that the population is any higher than this although it could be somewhat smaller. This is borne out by the fact that only one or two bears are killed from year to year, very few are sighted, and predation or crop damage from them is extremely rare. This last probably indicates the decline in the bear population as well as any factor. Up until 1920, crop damage and other types of predation from bears were common. Only one such report has been occasioned during the past 5 years.

At the present time, the bear is of little importance in the State as a game animal. Too few are killed to be of significance and should populations become dense enough to make hunting successful, it is quite likely that the resulting predation and damage to crops would become excessive. In recent years the season has been opened and closed without much justification. Unless it is desired to increase the bear population there is little reason to close the season.

SOUTHERN WOLF

The southern wolf (*Canis niger gregoryi*) is definitely a resident of the most thickly wooded, high lands of Louisiana, but at no time in recent years have wolves reached seriously high population in the State although their numbers have been on the increase.

RANGE:

The wolf in former years probably ranged over most of the State where game was abundant to prey upon. DuPratz (1758) reports that they commonly followed hunting parties and fed on the offal. Although wolves probably ranged over most of the State, there is some evidence that they prefer high, dry areas for their home ranges and dens. The present range of the wolf is primarily the high, densely wooded areas of the Upper Mississippi Alluvial Plain and the large isolated blocks of pine-hardwoods. Apparently, isolation is an important factor since some wolves are found in the isolated areas of the cut-over pinelands of southwest Louisiana. The present range of the wolf in the State is shown in Fig. 21.

GENERAL ABUNDANCE, FOOD HABITS, AND RANK AS A PREDATOR:

No attempt was made to determine the total wolf population. Complaints from a few sections regarding loss of hogs, sheep, and the suspected loss of deer, indicated that several areas of the State did contain a significant wolf population. Usually, a pack of from 5 to 12 were found to center their activities in an area of 40 miles radius and thereby covered a considerable area. Such packs were located in the vicinity of Caldwell, La Salle, Catahoula, Franklin, Tensas, and Madison Parishes. Others have been found in the Allen, Vernon, and Natchitoches areas. Predator-control men trapping the areas where complaints were made and on the various refuges took 100 wolves between 1947 and 1950. These catches were made in the areas mentioned above where the wolf population is highest. It is believed that this catch represents a large segment of the wolf population. The predator-control men report that only one or two wary individuals remain in most of the areas trapped. It is of interest to compare conditions in Louisiana with those reported from elsewhere. Young and Goldman (1944) report that there are an estimated 7,000 wolves in Alaska. Alaska's area is 12 times greater than Louisiana's and 30 to 40 times greater than the occupied range in Louisiana. This would mean that a population of 200 wolves in the limited range of this State is roughly equivalant per unit area to that reported for Alaska. Olson (1938) reports that some 250 wolves on a 2,500-square-mile area in the northern Minnesota wilderness consumed 2,000 deer or an average of 8 deer per year per wolf. Although Louisiana's 100 to 200 wolves are confined to an area only slightly larger than this, there is little evidence to support large deer kills in this State.

The food of the wolf consists of practically all types of animal matter both large and small. In this State, his basic foods are probably rabbits, rats, deer, and free ranging hogs, cattle, and sheep. Just to what extent they prey on deer is not known, but the major wolf packs do not necessarily congregate in the most densely populated deer areas.

In recent years, with expanded reforestation and aging of second-growth areas, the number of wolves in the State has increased. The predator-control program during the past 3 years has reduced their numbers considerably.

BOBCAT

Two sub-species of bobcat or lynx are native to Louisiana. According to Lowery (1943) *Lynx rufus floridanus* is the more common type occupying the alluvial flood plains of the eastern and southern part of the State and all of Louisiana east of the Mississippi River. *Lynx rufus texensis*, the other sub-species, is confined to the western part of the State. Little time was available to study this wary predator. Most of the attention was directed towards determining its general distribution, abundance, and damage as a predator.

RANGE:

The bobcat in Louisiana is, in general, found over the entire State where there is a large enough forest or other suitable isolation. It is particularly prevalent in the dense woods of the Mississippi Alluvial Plain and in the more heavily forested areas of northwest and west Louisiana (See map-Fig. 23). For example, bobcat have been found present on all of the large wooded areas in the State that have been selected for refuges; this indicates that the areas in the State most suitable for deer and turkey are also haunts of this predator.

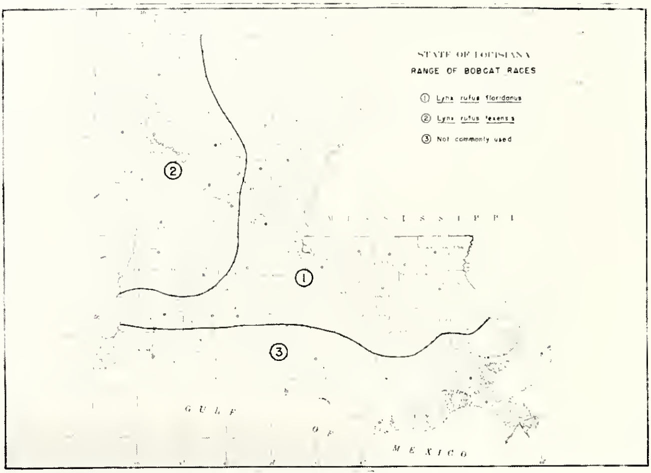


FIGURE 23.

General Population Distribution, Trapping Record, and Density:

No attempt was made to determine the population of this predator. The map (Fig. 23) shows those areas of the State where the species is most prevalent and where most of the predator trapping has occurred. In the past 3 years, more than 250 bobcats have been trapped by the predator-control crew. Most of this work has been in areas surrounding the various game refuges in the State. In one case, 94 bobcat were caught on an area of 150,000 acres over a 2-year period. This is an average of 1 cat per 1595 acres. In another instance, 109 cats were caught in a general area of some 400,000 acres, but this does not represent a thorough trapping job. Recently, one trapper took 32 cats in 30 days on a small area in Tensas and Madison Parishes. Although these trapping efforts are of no value in determining populations, they do tend to indicate the relative density of the bobcat in various areas of the State.

Food Habits and Predators:

The bobcat, like most feline carnivores, probably eats any live animal or bird that it can catch. Its chief diet is reported to be rabbit; and in Canada the population has been shown to fluctuate sharply with the varying hare population. It will also take sheep, calves, pigs, wild turkey, deer, and other game. Reports of stomach examinations in Louisiana indicate that rabbits and free-ranging hogs furnished the principal diet in the pine hill areas.

In general, there has been no great out-break of predation reported for this species although some complaints have come from the areas of denser population. Since the bobcat is quite wary and nocturnal, it is doubtful if the true nature of its predation can be judged by limited study.

FOX

The gray fox (*Urocyon cincreoargenteus floridanus*) is the only fox native to Louisiana, but fox hunters have from time to time imported and released the red fox (*Vulpes fulva*). The latter type has been trapped occasionally and no doubt is present in limited numbers in some parts of the State.

RANGE:

For the most part, the fox range in Louisiana is confined to the high, dry areas of the State; the pine hill section is particularly heavily utilized. In more recent years, the range has presumably been extended southward since animals are now reported and hunted in areas where 25 years ago a fox was never heard of or seen. This animal is so widespread in the State that considerable detailed investigation would have to be done in order to critically evaluate its ranges. (See map-Fig. 24).

POPULATION DENSITY:

The density of the fox population is not definitely known in Louisiana. Many reports and observations would tend to indicate that the population is higher now than at any time in recent years. Fox populations here, as in many other areas, go through cycles usually building up to a peak, at which time they are usually reduced by rabies, trapping, and poison. The trapping of foxes on refuge areas in routine predator control work has resulted in the capture of some 900 to 1,000 animals in the past 3 years on the same areas and during the same time that approximately 100 bobcat and 100 wolves were caught. Fox catches on various refuges per unit area are listed as follows:

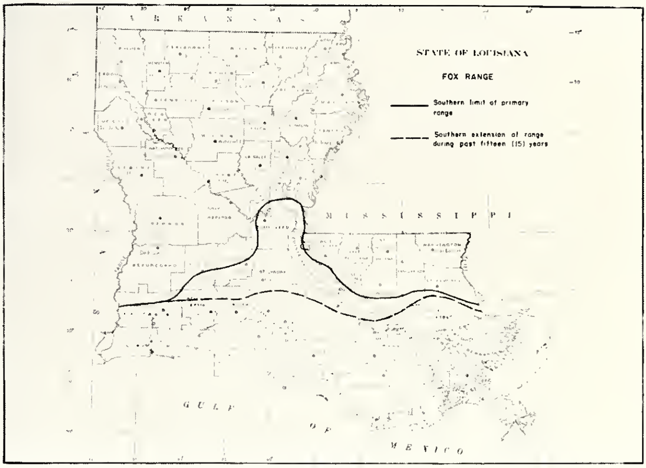

STATE OF LOUISIANA
FOX RANGE
Southern limit of primary range
Southern extension of range during past fifteen (15) years
ARKANSAS
MISSISSIPPI
GULF OF MEXICO

FIGURE 24.

TABLE 48B
FOX CATCHES PER UNIT AREA

Area	Size of Area Trapped	No. of Fox Caught	Acres per Fox Trapped
West Bay Refuge and Vicinity	100,000 A.	117	854
Livingston Parish Refuge	10,000 A.	2	5000
Union Parish Refuge	10,000 A.	40	250

The above table does not represent equal trapping effort or ability so it is not necessarily an accurate picture of fox density. On the other hand, it is the best information available at this time. Attempts to determine the fox density from fur catch records did not prove successful because so few are taken for the value of the pelt.

The Fox as a Predator and Game Animal:

There is little doubt that the fox is a predator of some game species when fox populations are high. The rabbit is the game animal most seriously affected by the fox. Turkey are likely to be affected most by losses while on the nest or through the destruction of nests. Fox predation is generally not considered serious enough to damage turkey populations but in Louisiana where turkey are at a critical low, it may be a factor. Contrary to popular belief, all research to date has indicated that quail are not seriously affected by fox predation. This is borne out in Louisiana by the fact that some of the highest quail populations in the State co-exist on the same range with foxes while low quail populations may occur where no fox are present.

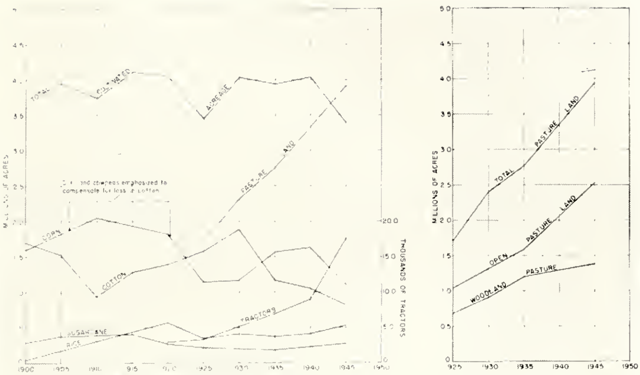
Although the fox is a predator it must also be considered a game animal. Fox hunting is becoming increasingly popular in the State. Foxhound trials and fox hunting clubs are popular, and the recreational value of this animal to a large group of sportsmen cannot be overestimated. It is believed, however, that the fox hunters could have better chases if the fox population were prevented from becoming too high and if some red fox were introduced in the area. Investigations by the Department of Wildlife and Fisheries toward determining how to obtain a balanced fox population suitable for hunting could be of considerable importance to the sportsman in the future.

FARM GAME

The term farm game as used here includes those species of game, birds, and animals associated with farm land and whose population and general welfare are greatly affected by farming methods and changes in the use of farm lands. The species involved are quail, dove, and rabbit. Fox squirrel, although associated with farms, has been placed in the forest game section because changes in forestry practices affect them more than changes in farm practices.

In general, the farm game species in Louisiana have shown a gradual decline since peak conditions were reached some 30 or 40 years ago. To the technician, this will not be surprising, particularly as the changes in land use practices are examined. Louisiana, like all of the States in the southeast, has gone through three general periods of land utilization on farms. They are in chronological order: (1) a period of extensive, crude, row-crop farming which made use of the negro tenant farmer, mule drawn vehicles, and hand labor; (2) a period when insect pests, such as the boll weevil, cane borer, and others, followed by the general economic depression of the late twenties, caused the farm production to drop off markedly—this period saw the beginning of pasture and cattle farming and increased farm cleanliness introduced as the answer to the downward trend of farm economy; and (3) the present period, when, in order to combat insect pests and to raise the economic level of the farmer, new crops, mechanization, clean farming, cattle production, and the widespread use of weed and insect poisons have become standard practice. These new methods are proving to be so good that there is a startling increase in these practices every year. The effect of these changes in farm land use on farm game conditions has been marked. It is the intent in this section to present an analysis of the change in the farming structure as it has affected game conditions, the past and present inventories of farm game, and future trends and recommendations. Hunting pressure, hunting trends, predation, and diseases will also be included, but all of the findings thus far would indicate that these factors have played a small part in the change in farm game populations, in particular quail.

All evidence gathered in this work substantiates the findings of Stoddard (1931), Baumgartner (1944), Mosby (1950), and



CHANGES IN ACREAGE OF CULTIVATED LANDS AND PRIMARY CROPS, 1900-45
CHANGES IN FARM MECHANIZATION AND PASTURE LAND, 1925-45

CHANGES IN PASTURE LAND

FIGURE 25, GRAPH V, GRAPH IV

other current workers in the field which indicate that the carrying capacity of the land is the primary governing factor in quail production. Throughout this discussion, the effect of land use changes on quail has been emphasized because most of the available references are on this major farm game species. It is believed that many other farm species will respond to changes in land use very much the same as quail.

AGRICULTURAL TRENDS IN RELATION TO FARM GAME BETWEEN 1900 AND 1950

The total acreage involved in farm land in Louisiana in 1950 is approximately 10,000,000 acres as compared to an estimated 5,500,000 to 6,000,000 acres in 1900. This total acreage can be broken down into three broad catagories: cultivated lands, pasture lands, and farm wood lots. Although the total land in farms has shown an increase during the past 50 years, this increase has not been due to great changes in the amount of land cultivated, but rather to a gradual but steady increase in the amount of pasture land. An examination of Table 49 and Graph IV will bear this out. Lands in cultivation have varied between 3,500,000 and 4,100,000 acres during the past 50 years with the 1945 figure being the lowest of the period and the 1950 trend still further

TABLE 49

FARM STATISTICS 1900-1945

Year	Cultivated	Pasture	Wood Lots	Total
1900	3,600,000[*]	xx		5,500,000[1]
1905	3,950,000[*]	xx		
1910	3,800,000[*]	xx		
1915	4,100,000[*]	xx		
1920	4,050,000[*]	xx	3,614,040	10,019,822[***]
1925	3,484,753	1,709,231	2,406,219	8,837,502[***]
1930	4,068,151	2,234,687	2,659,113	9,355,437[***]
1935	3,977,024	2,795,843	3,427,431	10,444,288[***]
1940	4,051,670	Unavailable	2,950,119	9,996,108[***]
1945	3,490,159	3,920,572	2,879,832	10,039,657[***]

[1] Estimated.

[*] Includes acreage of only four major crops. Actual total cultivated lands somewhat larger.

xx Pasture figure unavailable; presumed to be less than 1925 figure.

[***] Total land classified as farms by United States Census of agriculture. This figure may be slightly greater or less than the total of the figures listed in columns, 1, 2, & 3 because it includes unclassified lands and in some instances wood lots that are pastured were counted in both pasture and wood lots columns.

downward. On the other hand, pasture lands have increased steadily since 1920 and have made phenomenal advances during the last decade.

In comparing farm game population trends over the past years with the changes in the amount of farm game range, it soon becomes apparent that game populations have decreased while potential farm ranges have increased. This fact has been apparent to many, and various reasons for this condition have been offered. The immediate reaction by early observers and, in particular, by conservation-minded laymen was that gun pressure, predation, or disease were the agents, either singly or together, causing a decline in farm game while the range is apparently increasing. More careful investigations in recent years have indicated otherwise. Lead off by Stoddard's monumental work on the quail in 1931 and followed by the works of Errington and Hamerstrom (1935), Baumgartner (1944), Barkalow (1948), Phelps (1942 and 1948), Frye (1948), Marsh (1949), Thompson (1949), and Mosby (1950), we find a new idea based on field investigations being brought forth. In general, these investigators have found the following to be true about the productivity of quail range and the various factors influencing quail, a major farm game species in the southeast.

(1) Quail range has a definite carrying capacity based on the types, amount, and distribution of food and cover.

(2) The fall quail population usually represents the maximum carrying capacity of a given type range.

(3) Average amounts of predation, hunter kills, and winter losses due to starvation or other causes do not usually affect the fall population of the following year. In other words, the recovery from the spring low point is rapid and population is returned to normal by fall, if weather and breeding conditions are normal.

(4) Attempts to raise the fall or maximum carrying capacity of a range by restocking, predator control, and closed seasons have, in general, been decided failures.

(5) The only permanently successful way to increase quail populations is to increase the carrying capacity of the range by a change in land use practices, i.e., increase and maintain a better distribution of food and cover.

(6) Quail populations may show an annual fluctuation from factors affecting the breeding conditions, but generally any permanent change in the population is reflected from changes in the range.

Investigations on this project and on other Federal Aid studies in this and other States amply substantiate these findings and tend to indicate that other farm types react to land use changes much the same as quail do.

The following explanations of the changes in farm land use in the State as it affects game populations are offered as the major factors causing the decrease in quail and other farm game species in Louisiana during the past 30 years. These land use changes are discussed in more detail later as the management and increase of each species is considered.

The four major cultivated crops in Louisiana are cotton, sugar cane, rice, and corn. In addition to these, truck crops, dairy farming, and strawberries are important to certain localities. The farm map (Fig. 25) shows the distribution of all of these crops except corn which is grown as a rotation or supplemental crop in all areas. Since the total cultivated acreage in the State has varied little during the past 50 years, *a simple quantitative change in farm acreage is not the cause of the reduction in farm game.*

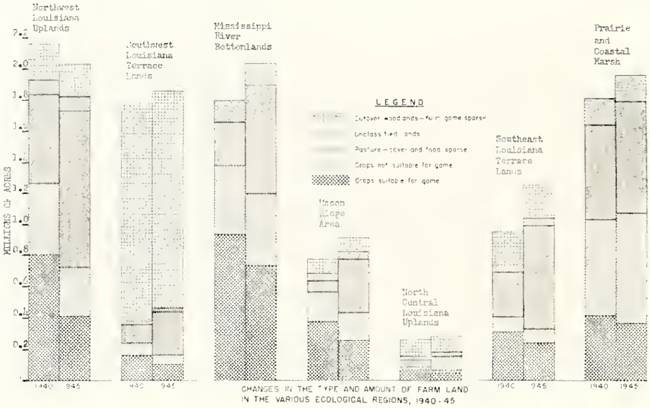


FIGURE 26, GRAPH VI

A study of farm statistics and the history of farming methods over the past half century indicates that the following factors have had most to do with the change in the farm game picture.

1. Changes in the amount of crops planted that are suitable for farm game.
2. Change from old style rotation of primary crops, legumes, and idleness to rest the land, to new methods of fertilization, winter cover crops, and primary crops without rotation.
3. Adoption of weedless farms, and winter plowing to eliminate insect pests and for the preparation of winter cover crops. (See plates 5 and 6).
4. Great increases in mechanization which, in general, make fall plowing more complete, brushy cover easier to clear up, and fnally results in a great loss of native food and cover.
5. Reduction of cultivation in the past 10 to 15 years in favor of pasture and beef cattle production which has caused a great reduction in food and cover in many areas. (Plates 7 and 19).
6. The total abandonment of some farms in certain areas in

PLATE 19

Pastured woodlands when heavily grazed have no under-story and are virtually deserted by game.

recent years, which resulted in a loss of range as these areas were taken over by forests.

7. The possible effect of insect poisons directly on farm game and the effect of new weed killers on native foods.

A study of the changes in farming between 1900 and 1950 will indicate how these changes came about and the resulting effects that must have occurred on game populations.

PERIOD FROM 1900-1910:

The turn of the century found all types of farming in Louisiana on the increase. Cotton was king and the vast numbers of livestock and tenants needed to work this staple crop required large plantings of corn, other grains, and legumes for food. Sugar cane and rice were both becoming prominent crops and, although neither is considered a good game crop, the types of crops rotated with them furnished good game conditions. For example, cane was rotated on a 3-year plan, i.e., 33 per cent of the plantation was in cane, 33 per cent in corn and cow peas, and 33 per cent idle or fallow. This was ideal for both quail and dove. Graph IV shows the acreages of the various crops involved and the general importance that should be attached to each.

Farming at this period, because it had to rely on hand labor and livestock for power, was, of necessity, somewhat crude. Ditchbanks, farm edges, idle field, and harvested fields all were left to wild growth because of a lack of time and man power. This, coupled with the various grain and legumes over the State, furnished the ideal in food and cover for farm game and the result was high game populations.

About 1905, a catastrophe hit the farmer with the arrival of the boll weevil and, by 1910, the cotton acreage was reduced by half. (See Graph IV). Although this resulted in near bankruptcy for the farmer, it was a boone to farm game, particularly dove and quail. Agricultural leaders, in an attempt to offset the loss in cotton, advocated the planting of great acreages of corn with cowpeas as a soil restorer and fertilizer. This resulted in a greater corn and legume acreage in the forthcoming decade than ever before or since. (See Graph IV).

PERIOD FROM 1910-1920:

The decade from 1910 to 1920 saw the high point of cultivation in Louisiana. During the period, grain and associated legumes were at their peak and the total farm acreage in cultivation at this time was the greatest that has ever occurred in the State. (See Graph IV). As was true of the preceeding 10 years, clean farming, the principal factor which works against farm game, was still a practice of the future, and all farm lands produced good game food and cover. This resulted in a period of the highest farm game populations that have ever occurred in the State. (See Graphs I, II and III).

PERIOD FROM 1920-1930:

The 10-year period from 1920-30 is marked by the control of the boll weevil and a return of cotton to its old status as a primary crop with a corresponding drop in the corn-legume acreage. (See Ggraph IV). Pastures show a sharp increase at this time and the sugar cane acreage dropped because of the cane borer. Mechanization on farms was just getting underway and advocates of clean farming as a protection against the boll weevil, cane borer, and other pests were making themselves heard. All of these changes resulted primarily in less foods and to a certain extent less cover for farm game on most of the farm areas. It was during the middle to latter part of this period that farm game started its long decline to the present low population.

PERIOD FROM 1930-1940:

This period represents the depression years. Cotton acreage fell to new lows, all other crops except corn declined. Many farms lay idle or were abandoned. A sharp increase in pasture acreage and some increase in mechanization and clean farming occurred. (See Graph IV). It was about the middle of this period that the cumulative changes of this and the preceeding decades began to be markedly noticeable to the hunters in the form of reduced quail populations.

PERIOD FROM 1940-1950:

This period witnessed the complete change toward a new system of farming in Louisiana. During this time, many changes have occurred that have caused a continued decline in farm game. The major changes have been a great decrease in row crops and a corresponding increase in pastures and grazing. (See Graphs IV, V, and VI). This has taken thousands of acres out of cultivation, thereby reducing farm game foods in two ways: first, by an actual loss of foods from planted crops; second, and more important, by the loss of native foods and cover grown in the form of weeds and wild legumes which occur when the soil is broken. In addition to a general loss of food, there has been a wholesale destruction of cover. On grazed lands, cattle strip the brushy acres of escape cover and graze down the grasses to carpet-like conditions. Briar patches and briar- and weed-covered ditchbanks, fence rows, and turn rows have totally disappeared in some areas. This has resulted in a loss of game where food occurs in the field because the game has no protection near the food source and therefore cannot utilize it. On the remaining small amount of cultivated acreage changes detrimental to game have been numerous. Old rotation plans have been discarded; new methods of fertilization, the use of hybrid type crops, the practice of fall plowing, and the use of winter cover crops keep the cultivated areas plowed up during some months of the year which are critical to farm game. (Plates 5 and 6). In addition to these new methods, the general trend toward clean farming has reached a peak with extreme mechanization, the use of weed burners, and various weed and plant poisons to control brush. At this time in many parts of the State, farm game cover is quite scarce and is being further reduced every day. Graph VI shows the direction and extent of many of the changes during the decade. It is important to note the great increase in pasture and the corresponding decrease in row crops.

Farm game during this period has reached the lowest point in the past 50 years largely because the natural food and cover conditions upon its range have been drastically changed and greatly reduced even though the total acreage of farmland has increased. That changes in the condition of the range as a result of changes in land use have caused this dearth of farm game is a conclusion which cannot be attributed to other factors. Studies of areas posted and unshot for periods of 10 or more years showed the same general decline in population as did hunted areas in cases where both areas were subjected to the new farming methods. On the other hand, areas still crudely farmed and retaining food and cover are apparently producing as much game as ever in spite of increased hunting pressure.

With the general trend of changes in farm game ranges and farm game in mind, it is now feasible to examine the present and past conditions of the individual species in the State as a whole and as they vary in the different agricultural and ecological regions.

Bobwhite Quail

The bobwhite quail (*Colinus virginianus*) is one of the major game species of Louisiana and, although in recent years its population has become somewhat reduced in the State, it still occurs in sufficient numbers to supply successful hunting to the diligent hunter. In all probability, more hunters, laymen, and technicians claim to know more about this one game species than all others put together; yet, in final analysis, bobwhite is still an enigma and much confusion exists concerning this popular bird. Some of the reasons that cause this confusion may be these which follow:

1. The difference in quail conditions in various areas and the bobwhite's varying reaction to such conditions.

2. The limited observations made by sportsmen during the short winter hunting season.
3. The fact that statistical analysis of quail conditions and populations belie casual observation.
4. The high variation in the success of taking this bird because of differences in cover conditions, hunter ability, and dog quality.
5. The failure of sportsmen and many other lay conservationists to know the biological principles of carrying capacity of range, high breeding potential, predator-quail relationship, and normal expected annual population fluctuations.
6. Other factors still undetermined may be controlling quail conditions more than is generally believed.

The findings of the quail inventory of Louisiana are presented here, first, for the State as a whole, then, for the various ecological or farming areas where conditions are different.

GENERAL LIFE HISTORY AND ECOLOGY OF QUAIL IN LOUISIANA

From the publication in 1931 of Stoddard's extensive work on the quail in Georgia until the present, much has been done and written concerning the general habits and ecology of the quail in the southeast. There is no need for a detailed reaccounting of these facts in this report, therefore, only the facts as they apply in Louisiana will be briefly outlined.

The occurrence of the quail in Louisiana is State-wide, although his numbers in the different ecological regions may vary considerably. The amount and distribution of quail in these various ecological regions of the State are governed almost exclusively by the amount and distribution of food and cover. In the coastal marshes and prairie areas, for example, shortages of both food and cover preclude large populations and cause quail to be distributed only along woody cover. All other regions have huntable quail populations more or less evenly distributed over them, excepting in the larger blocks of dense woods and swamps. On this investigation, quail were found everywhere a covey range existed and in no place excepting the marsh, clean prairies, dense woods, and large urban areas were quail conspicuous by their complete absence. To the fall hunter with an empty bag this may seem to be a questionable statement, but it is a statement borne out by the fact that in the spring of the year there is hardly a place in the State, excepting only those mentioned, where one is out of earshot of the call, "Bobwhite".

The quail in Louisiana use two distinct types of range. The bulk of the population is found on and associated with farm lands, but many quail use the cut-over pinelands and the thinly scattered longleaf pine woods. The conditions affecting quail in these two range types are distinctly different and will be discussed separately throughout this report.

The quail's breeding habits, daily movements, and general habits in Louisiana are essentially as described by Stoddard and other workers. Birds begin pairing off in April and reach the height of breeding in May and June. There is no evidence that they will raise more than one brood each year, even in the long summers of Louisiana. Ample evidence is available, however, to indicate that many efforts will be made to bring off one successful brood. When extremes of weather or other factors prevent successful breeding early in the year, breeding continues into the fall and young birds have, on occasion, been seen in October and early November. The average size of the brood hatched is usually between 12 and 16 birds, but losses between hatching and adulthood reduce the brood considerably. Average covey sizes range between 10 and 12 birds, but this includes unmated males and stray birds or in some cases two or more broods. Studies by Perkins (1950-51) indicate that the average covey size is below 10 birds in the southwest pinelands of Louisiana. (See table 54). This is not surprising since this area represents the poorest range, from a food standpoint, in the State, and many investigations have shown that food conditions control the size of a covey using a given range. (Stoddard 1931, Barkalow 1948). Further evidence to support this contention has been found during this study. In many instances during the quail investigation coveys shot down during the early part of the season have been found reestablished and as large as ever on the same range later in the season. This has only occurred where food was plentiful on the range.

There has been ample evidence produced by various investigations to indicate that quail coveys or individuals have a short home range and rarely more than one-fourth to one-half mile. (Trippensee

1948). This is generally true in Louisiana except in the southwest pinelands. In this area, it is not uncommon for coveys to range daily a mile or more and, in some instances, coveys are forced to range considerable distances from escape cover in order to find sufficient food to survive on. In some instances, coveys have been found from 600 yards to one-half mile from the nearest sign of cover. This is indeed an exception from the findings of most investigators. It would seem that the scarcity of food in the pine barrens has caused quail to adapt themselves to a longer radius of range and a willingness to fly farther to escape cover. Perhaps there are fewer overhead predators in the area, but no evidence of this is had. Certainly this condition makes individual coveys in this area more susceptible to gun pressure as they are quickly shot down to one or two birds. On the other hand, many coveys are encountered in the pine barrens that stay so near cover that they are just as hard to eliminate as those in the thick brushy country.

General Food and Cover:

No detailed quail food habit studies were carried out on this project nor have any ever been done for the various areas of the State. In making this inventory, an attempt was made to determine the more important foods used in the various ecological sections of the State as well as the general food habits of quail. As pointed out by Stoddard and Handley, quail are practically omnivorous, eating many types of legumes, grass seed, mast, fruits, and insects. The important aspects of a food study are the utilization of foods on an annual basis and the quantitative use and presence of preferred types. Table 50 taken from Trippensee (1948) is a summation of the findings of Stoddard and Handley (1931). It is being used here to indicate general conditions and as a guide to the discussion of food conditions and shortages in the various ecological regions which will come later in this report.

The importance of the food habits as outlined in the above table is the difference in the utilization of the more important foods at various times of the year. In winter, seeds from legumes and various types of mast are the mainstay of quail. Findings on this study indicate this to be true in Louisiana except that there are variations in utilization in the different ecological sections. Summer foods are primarily fruit, berries, weed seeds, and insects. This is a point in the food cycle that is too often overlooked by the casual observers and it is at this point that clean farming has done the most damage. On modern farms, the miles of blackberry and dewberry covered edges, fence rows, and ditch banks that used to provide cover and food are now gone. This loss of native plants and cover plus the widespread use of D.D.T. and other insecticides have also removed much of the insect source of game foods in many areas.

The more important factors concerning quail foods are these:

1. Cultivated crops per se are not a great souce of quail foods (see Table 50), but rather the native legumes, weeds, and grasses which result from breaking the soil are the foods that sustain quail.
2. Quantity as well as quality must always be considered. Few people realize the actual volume of food necessary to support a covey of birds.
3. A year round supply of food is vitally important. The population is governed by the lowest point in the annual food cycle rather than the highest.
4. No amount of planted or native food is of any value to quail or other farm game type if escape and travel cover are lacking. Quail must have a means of reaching the food supply safely or it will not be used.

It is all too plain that losses in the quantity and quality of food and cover have been the primary cause of the decrease in quail in Louisiana. It is very difficult to assess the amount of this loss but, as one drives through the country and sees thousands and thousands of acres of pasture grazed to a grassy carpet with not a shred of bird cover or food, the impression is that the change has been tremendous. In questioning landowners about quail conditions time after time, a change in land use which destroyed food and cover was found to be coincident with the drop in quail population. Many times the story went like this. A landowner bitterly complained of the loss of quail on his land, blaming everything from the city hunters to the fox and armadillo. His story would be that he used to have 20 coveys on his place; now he is lucky to find 5. Upon being questioned about changes in land use, his answer was something like this: "Oh yes, before the war I had several tenants, planted cotton and corn and truck crops for home consumption. Labor got so scarce and so high during the war that I had to quit. I've put most of my land in pasture and I've 200 head of the finest cattle you

TABLE 50

MONTHLY AND YEARLY PERCENTAGES OF THE VARIOUS ITEMS IN THE FOOD OF 1,659 ADULT BOBWHITES IN THE SOUTHEAST*

Kind of Food	Occurrence of kinds of food as a per cent of the total												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
Vegetable foods:													
Seeds:													
Legumes	47.2	52.9	33.2	19.5	14.5	3.4	5.7	4.0	1.3	10.6	23.9	33.1	20.8
Grasses and sedges	5.4	2.1	1.9	4.0	6.7	3.4	5.5	28.3	43.8	30.1	11.1	2.6	12.1
Cultivated plants	1.2	1.6	4.7	0.4	1.2	2.9	Trace	3.3	9.1	0.6	6.3	5.0	3.0
Miscellaneous	1.8	3.6	5.3	26.1	32.5	11.4	15.9	10.7	7.1	14.4	11.9	3.5	12.0
Mast	29.7	15.7	24.4	17.2	0.8	0.4	0.1	Trace	......	1.5	32.7	38.6	13.4
Fruit	8.0	10.3	3.0	12.4	17.8	58.4	51.1	27.7	24.8	5.1	4.0	10.2	19.4
Forage, tubers, misc. items	4.4	11.6	23.9	7.3	4.7	0.8	Trace	2.7	......	Trace	0.9	1.9	4.9
Totals	97.7	97.8	96.4	86.9	78.2	81.0	78.3	76.7	86.1	62.3	90.8	94.9	85.6
Animal foods:													
Insects	1.9	1.8	3.5	12.8	20.8	18.6	20.9	21.3	13.7	37.7	8.7	4.9	13.9
Miscellaneous items	0.4	0.4	0.1	0.3	1.0	0.4	0.8	2.0	0.2	Trace	0.5	0.2	0.5
Totals	2.3	2.2	3.6	13.1	21.8	19.0	21.7	23.3	13.9	37.7	9.2	5.1	14.4

* After Stoddard and Handley from Trippinsee (1948).

PLATE 20

Note difference between burned and unburned areas. This picture also shows typical cut-over pinelands quail range to the left and rear.

ever saw. I now have several tractors and do most of the work myself. The only planting I do is some hay and grasses." In looking over his land, the biologist often wonders where the five remaining coveys manage to survive. It is usually greatly lacking in food and cover and the small amount of these that do remain is poorly distributed. (Plates 7, and 19). This type of change has been excessive over most of the farm land quail range, particularly in the bottomland and more intensively farmed hill areas.

Food and cover conditions on ranges other than farm lands have also showed considerable change. In the cut-over pine lands, poor soils and crowding by thick growths of perennial grasses have resulted in a great reduction in the production of natural foods, primarily the legumes such as lespedezas, beggarweed, and partridge peas. (Plates 16 and 20). Pine mast, an excellent food, is not usually of annual occurrence. Cover, in general, in the pine land is good but in many instances it is not near enough to the food supply because it is separated by heavy growths of perennial grass rough unsuitable for ground travel and over which the birds are not

PLATE 21

Uncontrolled fires remove much of the protective cover in the cut-over areas. Hot burns may leave the ground virtually bare.

too prone to fly for food. In the main, however, this type of range lacks food.

RECENT HISTORY OF QUAIL IN LOUISIANA:

Although there are no available quail census figures for the years 1900-1940, the general changes in quail population during this period are readily determined. It is quite clear that the quail population must have reached an all time high sometime between 1910 and 1920, with the peak carried over into the early twenties. The reasons for this high population are clear when land use practices and range conditions are considered. As pointed out in the discussion of agricultural practices above, this was a time of maximum but crude type farming. Peak acreage of planted grains occurred during this period. Methods of rotation, rotational legume crops, and general native food and cover were such as to offer the maximum in range acreage of the best food and cover types on farms. At the same time that the agricultural quail range reached its maximum production, the pine land ranges were also at maximum production. Some 4,000,000 acres of virgin longleaf pine in southeast and southwest Louisiana were being rapidly cut. As this pine was cut, a plant succession began which furnished a maximum of quail foods for a period of 5 to 8 years after cutting. This succession included the production of great quantities of native legumes such as wild lespedezas, partridge peas, beggar weed, and many miscellaneous seeds. As the land was exposed to the elements and annual fires, its small amount of fertility collected over the years as a forest floor was soon used or leeched out, resulting finally in a completion of the primary succession with the establishment of wire grass and broom sedge roughs. Quail food under such conditions were at a premium and the population fell off rapidly.

Although the general decline in quail population probably started in the late twenties, it was not until the mid-thirties that the sportsmen began to complain of quail shortages. The cause for this gradual decline was two-fold: one includes certain changes in farming methods such as a reduction in the amount of legumes and grain planted, increase in cattle production, and an increase in mechanized or clean farming. (See Graphs IV, V, and VI). The second involves the loss of the general productiveness of the pinelands as wire grass and sedge roughs replaced native foods; some general decrease in range also occurred because of reforestation. The gradual cumulative effect of all of the forces working against the suitability of the range for the quail reached a maximum in the thirties and brought the quail population to its lowest ebb. It was at this point that hunter effort began to be reduced to a minimum. Many of the older hunters who had known better days sold dogs and put away guns. They decried the absence of quail and influenced many younger sportsmen to give up or never start quail hunting. It was during this period that the quality of bird dogs was lowered and the finer points of the art of quail hunting were much reduced, if not lost, by most of the sportsmen of the State.

There is some evidence that there were slightly higher quail populations during the late thirties and early forties, probably as a result of better breeding and food. Since that time, populations on pineland and pine hill farm ranges have remained fairly stable. Clean farming and conversion to pasture and cattle production throughout the alluvial bottomland areas and in the more intensively farmed hill areas have resulted in a further decrease of quail populations in these sections. The result here has been, in effect, a loss of range due to the inability of the birds to use large acreages that are totally devoid of protective cover. (Plates 6, 7 and 19).

At the present time, the quail population is lower than perhaps at any time, yet there are still enough birds to furnish reasonably successful hunting to the diligent hunters.

GENERAL QUAIL CONDITIONS AND POPULATIONS IN LOUISIANA

PRESENT POPULATION, POPULATION DISTRIBUTION AND RANGE:

At the time of this inventory, Louisiana's quail population was determined to be approximately 1,240,000. This represents an average peak fall population taken over a three-year period and is probably near a maximum estimate for existing conditions in the State. The normal fluctuation that may occur between good and bad years probably ranges between 900,000 and 1,250,000. After a study of the available information on peak populations attained between 1910-1920 it is believed that the present population represents between 30 and 40 per cent of the maximum that has ever occurred in the State or a drop of 70 per cent during the past 35 years.

Table 51 shows a general broad breakdown of the amount of quail range, population on range, and population density in the State.

TABLE 51

SUMMARY OF QUAIL INVENTORY

Total State area	28,913,280 acres
Occupied range (farm & associated land)	8,117,259 acres
Occupied range (denuded pine land)	2,130,890 acres
Total occupied range	10,248,149 acres
Population on farm type range (approx.)	1,100,000
Population on denuded pine range (approx.)	740,000
Total quail population	1,240,000
Average density on occupied range	1 quail on 8.2 acres
Average density, entire State	1 quail on 23.3 acres

The above figures indicate that the vast majority of quail are associated with some 8,000,000 acres of farm and associated lands, while only about 12.7 per cent of the total population is confined to the denuded pine areas. The average density of 1 bird in 8.1 acres falls within expected limits on unmanaged range. The density figure as presented here for the occupied range in the State and in particular for farm acreages, in the opinion of the investigator, is slightly high. The reason for this is that the term occupied range as used in the report represents primarily those lands which support heavy enough populations to be huntable. Very sparsely occupied, dense unhuntable forest areas were considered as part of the unoccupied range. By using this method, a somewhat higher population density was obtained on the occupied areas because they represent the best available quail range in the State. On the other hand, the total population determined in this manner is low because the total acreage involved is considerably less than when large forest areas are added. An examination of Table 52 will bear this out. The density per unit area determined by Penn and Wallace for 1940-41 is practically the same as that determined on this project in 1948-49, yet the total population calculated by their system of using a conversion factor to account for birds in forest acres results in a higher total population. On this survey, the dense forest lands were considered as unoccupied because the sparse population there, though of some value as breeding stock, makes up little or no part of the quail population available for harvest.

The density of 1 bird on 8.2 acres represents the estimated average maximum carrying capacity of the presently occupied range with the land use practices now in vogue. Larger populations were carried in the State in the past years not only because of higher productivity of the range (1 bird to 3 to 5 acres) but also because a greater amount of range was suitable for utilization by quail. Much evidence tends to indicate that some of the farm lands have been so cleaned up or so heavily grazed that they should not be considered as part of the existing range. (Plates 19-22). A comparison of the changes over an eight-year period between 1940 and 1948 may shed further light on the trend in quail production. Table 52 lists a quail inventory of 25 Louisiana parishes by Penn and Wallace (1941-42) and the same 25 parishes as determined on this project. Since these parishes represent the bulk of the better quail territory in the State, the result should indicate State conditions as a whole. The methods used in determining these two inventories were basically the same: a sample

TABLE 52
COMPARISON OF 1940-41-42 QUAIL INVENTORIES WITH 1948-49 INVENTORY

Parish	Acres/Covey 1940-41	Acres/Covey 1941-42	Acres/Covey 1948-49	Per cent Change 1942-49	Estimated Pop. 1940-41	Estimated Pop.* 1941-42	Estimated Pop. 1948-49
Bienville	56	56	66	−15.2	68,000	96,000	36,000
Bossier	139	62	69	−10.2	32,000	77,000	36,000
Caddo	178	110	109	....	25,000	49,000	35,000
Caldwell	138	136	30*	+78.0	10,000	11,000	11,000
Catahoula	71	70	115	−39.2	34,000	37,000	10,000
Claiborne	88	59	60	....	74,000	129,000	57,000
Concordia	257	265	115	+57.7	17,000	22,000	7,000
De Soto	90	60	78	−23.1	63,000	109,000	37,000
East Carroll	56	40	67	−40.3	42,000	63,000	15,000
Franklin	70	60	65	− 7.7	58,000	76,000	42,000
Grant	45	47	95	−50.6	44,000	45,000	17,000
Jackson	54	45	54	−16.7	57,000	69,000	25,000
La Salle			95	....	6,000	10,000	4,000
Lincoln	57	40	54	−26.0	48,000	100,000	49,000
Madison	63	57	84	−32.2	68,000	82,000	12,000
Morehouse	55	40	75	−46.7	77,000	108,000	32,000
Natchitoches	82	79	112	−29.5	81,000	100,000	32,000
Ouachita	58	34	55	−37.2	57,000	129,000	30,000
Red River	66	69	84	−17.9	44,000	42,000	25,000
Richland	51	38	78	−51.3	80,000	111,000	31,000
Sabine	97	54	300*	−82.0	31,000	66,000	21,000
Tensas	117	99	87	+12.2	45,000	56,000	12,000
Union	48	36	60	−40.0	82,000	127,000	44,000
Webster	75	59	63	− 6.4	51,000	76,000	36,000
West Carroll	42	36	65	−44.7	61,000	79,000	24,000
Winn	68	47	58	−19.0	32,000	55,000	23,000
Total	72.6	54.8	73.9	−25.9	1,287,000**	1,924,000**	703,000**

* Population change not as great as indicated. Difference due to method of inventorying woodlands.

** Difference in total population not actual because total range determined differently. Change in density per unit area more representative of actual difference.

per unit area population was determined and this index was applied to the total area. The differences between the two methods involved the size of the sample taken and the method of evaluating total range acreage. In the present inventory, the sample taken averaged 10 times as large as the one taken in 1940-41 which should give a more reliable density per unit area figure. A much more critical evaluation of the total lands involved in quail range was used in 1948, resulting in a total range figure somewhat less than would have been arrived at, had the present inventory used the same method as Penn and Wallace. This of course, would mean a lower estimated population in 1948 even if no change occurred in the density per unit area.

In Table 52, an examination of the quail densities indicates first that a 25 per cent differential may occur from year to year as indicated by the increase from a covey in 72.6 acres in 1940-41 to a covey on 54.8 acres in 1941-42. Futhermore, it is also clear that the average 1948 findings of a covey per 73.9 acres although showing a 25.9 per cent decline from the 1942 high is approximately the same as the 1941 density and is within the limits of normal annual fluctuations. At first estimate, this would tend to indicate that there has been no significant decline in the productivity of the range per unit area over the 8-year period. In the opinion of this investigator, there is some evidence of a decline. The 25 per cent differential from one fall to the next found by Penn and Wallace probably is near the maximum fluctuation that can be considered to be normal. This would mean that the 1940-41 density was an extremely low production year while 1941-42 figures represent an extremely high production year for the quality of the range in existence at that time. On the other hand, the average density found on the 1948 inventory is indicative of the average production over a 3-year period. It probably approaches the maximum that can be expected as evidenced by the fact that during 2 of the 3 years excellent production was attained as indicated by high young-old ratios. Since this is the case, the 1948 density representing an average to high condition is only equivalent to the lower producing years in the late thirties or early forties. This decline in production per unit area is probably a direct result of the increase in pasture lands and clean farming on the farmlands in the 25 parishes studied.

In examining the total estimated populations for the various periods not much significance can be attributed to the difference between the 1941-42 and the 1948 figures since there is a difference in total range estimated. It is believed that the more conservative figure used in 1948 is near the total huntable and manageable quail population in the State and probably nearer the over-all total; nevertheless, the findings on these two separate investigations place Louisiana's total quail population somewhere between 1 and 2 million birds which is enough to take care of an estimated 15,000 quail hunters satisfactorily. If the hunter population increases beyond this point, the total quail population is not likely to be hurt, but hunter bags will decrease below the point of successful hunting.

A further analysis of the present quail conditions in the State is shown in Table 53. Here the State's total quail population, total range, and densities are broken down by ecological types, and the relative per cent of production in relation to per cent of quail range is shown. These data summarize the relative productivity of the various ecological areas.

A study of the above table indicates that only three of the ecological areas are producing quail in a reasonably satisfactory manner. The Macon Ridge Area, the Northwest Louisiana Uplands, and the Southeast Louisiana Terrace Lands produce nearly 65 per cent of all of the quail in the State on only 48 per cent of the State's range. The remaining 35 per cent of the birds occupy the four other ecological areas, most of them being in the Mississippi-Atchafalaya bottomlands only because of its large size and not because of good range. Further examination of the table will indicate that large acreages of cut-over woodland range exists in the Southeast and Southwest Louisiana Terraces. In the latter section the pineland range far exceeds the farmland range. Densities on these denuded pine areas are very low but such areas probably represent the best possibility for successful quail development work. The popualation densities as listed in acres per bird range from 1 bird in 5.8 to 1 in 30 acres. A density of 1 bird in 5 or 6 acres, represents about the best that can be expected under present land practices without intensive management. Densities of 1 bird to 10, 15, or 30 acres on the other hand, indicate that something is preventing the land from producing as it should. Densities on such areas offer some possibilities of improvement with a reasonable amount of management or perhaps

TABLE 53

SUMMARY OF QUAIL INVENTORY DATA BY ECOLOGICAL TYPES

Section	Total Area	Total Quail Range		Estimated Total Population	Density Acres per Bird		Per cent of Area in Quail Range	Per cent of State's Range in Area	Per cent of State's Quail Population in Area
		Farms & Associated Lands	Cut-over Wood-lands		On Range	On Total Area			
Miss.-Atchafalya Bottomlands	6,197,720*[3]	1,844,000[3]	........[3]	207,564	8.9	29.8	29.7	18.0	16.55
Macon Ridge	1,829,928	801,000	....	136,224	5.9	13.4	43.8	7.8	10.86
N.W. Louisiana Uplands	5,706,240	2,359,569	209,444	437,724	5.8	13.0	45.0	25.0	34.91
N. Central Louisiana Uplands	1,918,675	244,825	108,740	57,576	6.1	33.3	18.4	3.5	4.59
S.E. Louisiana Terraces[1]	3,063,680	1,177,865	418,704	251,756	6.3	12.2	50.4	15.1	20.08
S.W. Louisiana Terraces[2]	3,415,359	594,000	1,394,002	124,608	15.9	27.4	58.2	19.4	9.94
Coastal Marsh & Prairie	6,781,678	1,146,000	....	38,256	30.0	177.2	19.7	11.2	3.05
Total	28,913,280	8,117,259	2,130,890	1,253,708	8.2	23.06	35.4	......	......

* Red River Bottomlands not included in this total.

[1] Florida Parishes.

[2] Southwest cut-over pineland.

[3] All figures in acres.

only slight change in land use. The details of the limiting factors and the corrective methods differ for each section and will be taken up later in this discussion on quail.

HUNTER SUCCESS, KILL, HUNTING PRESSURE:

Although one hears many complaints about the dearth of quail in Louisiana and the poor hunting, all evidence that has been gathered on this project shows this not to be entirely the case. Successful quail hunting is so closely controlled by hunter effort, dog quality and the hunter's knowledge of quail, that it is difficult to analyze. One thing definite, however, is that if the effort and ability are put into quail hunting as good results will be obtained in Louisiana as in most of the Southeastern States. There will always be some who will not kill quail and probably would not under the best conditions. For example, Thompson (1949) in a study of Mississippi quail hunters found that 30 per cent of the hunters bagged more than 70 per cent of the annual kill. Such an unequal distribution of hunter success cannot be blamed on population or range conditions.

In Louisiana, Perkins (1950-51) collected some data which, when statistically analyzed, indicate the hunter success to be expected by the average hunter-dog combination. The following table summarizes these findings:

TABLE 54
A SUMMARY OF AN ANALYSIS OF HUNTER-SUCCESS IN CUT-OVER PINELANDS*

No. hunts	Hours hunted	Coveys found	No. killed	No. crip-pled	No. seen	Males killed	Females killed	Mature	Im-mature
49	228	103	281	39	928	138	140	57	231

Summary of Data Analysis

Quail killed per hour	1.23
Coveys found per hour	.45
Quail killed per covey	2.72
Quail killed per hunt	5.75 - 2.87 per hunter
Average hunting time	4.66 hours
No. coveys found per hunt	2.10
Average covey size	9.19
Mature-immature ratio	20% - 80%

*Perkins (1950-51)

The above statistics were collected by Perkins in the fall and winter of 1950-51. These data represent the hunting results of trips in the cut-over pine areas where some of the lowest bird populations in the State occur. This is off-set to some extent, however, by the ease of hunting in this open country. If they accomplish nothing else, these data refute the complaints of many hunters that there are no birds left to kill or that populations are too low to be hunted successfully. In this area of very low populations, 2 men hunting twice a week for the duration of the quail season would kill about 126 birds between them. This is based on a total of 22 hunts of 4.6 hours each. If the hunts were extended to an 8-hour period, a season limit of 80 birds per man could easily be attained. Better shooting would also bring up the bag, as only 2.72 quail per covey were killed in the above statistics. It is quite evident from these data that the primary reason for small season kills in Louisiana, is in most cases a lack of hunting effort on the part of the hunter. Season limits are attained year after year by diligent hunters in Louisiana. Careful questioning of self-styled quail hunters indicate that most such persons make less than 10 hunts a season and it is doubtful if such small effort could have produced great kills even during years of peak populations. It should be recognized by all concerned that present-day quail hunting is not an easy afternoon pastime to be undertaken once a week nor is there any evidence that there ever was such an easy way to successful hunting. Quail hunting is rather an expensive, highly specialized sport requiring considerable time, effort and know-how both on the part of the hunter and the dog. Successful quail hunters are in two categories: (1) those who have the time, money, and ability to seek out quail areas and hunt at least two full days a week during quail season and (2) those fortunate enough to live in suitable areas who can put in a few hours of hunting several times a week. In almost all cases successful hunters now and in the past have gone to the trouble to locate some of the coveys they intended to hunt well before the season opened.

Attempts to determine total kill and hunting pressure from a sound statistical analysis have not been successful. Louisiana's use of a blanket license system for all kinds of hunters, the failure of questionnaire methods, and the lack of numbers via the personal interview method can only furnish the roughest estimate of the total kill. Certain statistical facts about quail kills were fairly easy to obtain, but the total number of persons hunting quail could not be accurately determined. Table 55 lists the comparative findings from several sources. It is doubtful if any of the figures in Table 55 in any instance, except the one so listed for the State of Mississippi, represent anything like a random sample. It seems fairly clear, however, that all sources indicate the average season effort to be probably 10 or less hunts with a total kill of between 20 and 30 birds. This would tend to confirm the opinion that hunting effort directed at quail is not unusually great in Louisiana. Futhermore, findings in Louisiana agree with Thompson's (1949) results that the majority of quail are killed by a select few diligent and expert hunters. This would explain why so many license-holders fail to kill what they think to be their rightful quail harvest. In final analysis, they simple fail to work hard enough at hunting.

The total quail kill as listed here for Louisiana is purely an estimate as the total number of quail hunters was not obtainable by the methods tried on this project. Most of the quail hunter population data seemed contradictory. Questionnaries on this project and interviews by the United States Fish and Wildlife Service indicated that between 40 and 50 per cent of the white hunter population hunt quail. On this project, the sample was biased by being taken in quail regions—yet results were in disagreement: they showed that only 14.2 per cent of the hunters owned bird dogs while 42.8 per cent claimed to have hunted quail.

The personal interview methods used by the biologists on this project definitely left them with the feeling that there was a great scarcity of real quail hunters, and certainly nothing like 40 per cent of the total hunter population.

In trying to make a final estimate of the total annual quail kill in the State, the fact that much of Louisiana is not quail range must be considered. It is believed that not more than 200,000 quail are taken in Louisiana annually although it is possible that as many as 500,000 may be taken, This latter figure would be more in agreement with the findings in Mississippi since Louisiana has about half the quail range found there.

From a quail managment standpoint, the effect of hunting pressure on total population should be known in order to set seasons and bag limits, and to direct management. It is the confirmed opinion of this biologist and many of the other biologists familiar

TABLE 55

COMPARATIVE QUAIL KILL DATA

Method	Average No. Hunts/ Season	Average Quail Killed/ Hunt	Average Seasonal Kill	Estimated Quail Hunters	Estimated Total Kill	Remarks
Louisiana questionnaire	5.8	3.4	20	30,000	600,000	Forms a biased sample of good hunters in quail areas.
Louisiana interviews	7.0	3.0	21	10,000	210,000	Small sample from each parish.
Louisiana data (Perkins)	....	2.87	....	....	....	Represents accurate check of kill per hunt.
Mississippi questionnaire (Thompson)	16.4	4.0	65.9	....	....	Selected exceptional quail hunters.
Mississippi questionnaire (Thompson)	....	....	26.0	38,500	1,000.000	Random sample.

with Louisiana's quail conditions that hunting pressure is not now affecting the quail populations to any extent nor is there any evidence that it has played any serious part in the gradual decline of the total quail population from years past.

It is realized that many persons, both uninformed and informed, will probably take issue with this concept, but recent findings by competent, independent investigators more than substantiate this opinion. Errington and Hamerstrom (1935) and Baumgartner (1944) have indicated that moderate quail harvest only serves to utilize the birds that would be lost each winter even without shooting. Their concept is that land will produce its maximum carrying capacity regardless of harvest. Thompson (1949) claims that Mississippi with an annual harvest of 1,000,000 birds is not overshot. Mosby (1950) probably has made the most significant findings of recent years. His investigations indicate that surviving spring populations ranging as low as 18 per cent of the previous fall high, could produce to the maximum carrying capacity (i.e., 100 per cent population) by the following fall. Shooting during 1 year did not have any effect on the fall populations of the following year in test harvests. Frye (Florida Fish and Game Commission) at the presentation of Mosby's paper expressed the opinion that there is possibly no such thing as overshooting quail. (Trans. of the 15th. North American Wildlife Conference.)

Direct observation in Louisiana more than substantiates the conception that quail range produces to its maximum ability at which point populations do not rise further. There is also ample evidence that heavy shooting has little or no effect on the subsequent fall population. Following are described some observations and studies made during the course of this project which tend to bear out these points.

1. Comparative quail censuses between two similar areas, one open to hunting and one unshot for a period of years, failed to show any difference in population per unit area.
2. Thousands and thousands of acres of posted and unhunted land in various parts of the State have failed to show any evidence of having better quail or other farm game

populations either when censused by us or as reflected by public opinion.

3. Three heavily-shot areas studied over a 3-year period all showed quail populations equal to or better than surrounding lightly hunted or unshot areas. In one of these cases, the birds were so shot down by the end of the second week of the season that hunters avoided the area yet the following year, the same number of coveys were present.
4. The trend of hunters to hunt their favorite areas year after year should indicate that areas with a good carrying capacity will always produce in spite of hunting.
5. Even if hunting pressure was proven detrimental to the quail population it could not be blamed for low populations in Louisiana. There is ample evidence that thousands of acres of quail range in Louisiana are hunted very little, if at all. For example, in 4 years of hunting in the cut-over pine lands, this investigator has encountered only three quail-hunting parties. Besides this, the posting of land in the State has made a virtual refuge of some parishes. Yet with little or no gun pressure, the population has remained low on these areas.

In concluding this analysis of hunting and hunting pressure, it should be made plain that the analysis is based on the current hunter population which is believed to be moderately low. The total number of birds in the State can take care of this hunter population even if the hunters hunt hard. If, however, the total quail hunter population were suddenly increased, fewer and fewer birds would be bagged by the individual hunter and although the total production of the State might tend to stay constant and the harvest about the same, the individual hunter would see a relative decline in birds as measured by his bag.

Limiting Factors and Quail Potential of Louisiana:

The primary limiting factor controlling the annual maximum quail production is of course the limit of food and cover or its improper distribution. Many factors may affect food and cover either temporarily or permanently and these factors, therefore, more or less control quail production. Some commonly encountered in Louisiana are these: (1) clean farming, (2) increased pasture and grazing, (3) weed and brush control, (4) loss of range from reforestation, (5) poor food conditions in the pinelands, and (6) lack of an annual food supply because plowing or some other such land use practice destroys the food and cover at a critical time in the year.

Those factors affecting populations only temporarily for one or two seasons are weather conditions, uncontrolled forest or grass fires, predators in certain areas, and disease. This group of factors usually affects the breeding season by lowering the total out-put for one or more seasons, or else directly affects the carrying capacity of the range by failure to furnish food as in extremely dry years. The findings of Mosby and other investigators show that the recuperative powers of quail populations are very great, however, and losses due to such factors are rapidly overcome. Since the exact nature of the limiting factors controlling quail in each ecological division is different, the discussion of each factor as it affects quail will be considered there.

The quail potential of Louisiana varies from one ecological region to another and will be discussed in some detail under each heading. At this point, it is necessary to emphasize that Louisiana's maximum quail range is confined to some 10,000,000 acres and its total production of quail is therefore limited to this area. To date, the theoretical maximum number of quail that can be developed is one bird to the acre. All investigators agree, however, that over-large areas, only partially managed as a State might be, a maximum average production of one bird in three or four acres is all that could be hoped for. If this proves to be true, Louisiana's quail population can be expected to be increased about one and one half times its present number to some 2,500,000 birds if properly managed. This would allow for a safe harvest of 1,000,000 or more birds annually and would make Louisiana one of the good quail areas of the Southeast.

Since some ecological areas in the State are now producing near the maximum population, with a bird to three or four acres, little change should be expected there even with management. The greatest effect of management and increase in quail populations will occur in those regions not now producing well. The potentials and recommendations for the improvement of each ecological region is discussed under such headings.

QUAIL IN THE MISSISSIPPI-ATCHAFALAYA BOTTOMLANDS

Range, Population, and Density:

The Mississippi-Atchafalaya Bottomlands Area consists of some 6,000,000 acres of bottomland forests and swamps and highly productive sugar cane, cotton, and cattle land along the Mississippi and Atchafalaya Rivers. (Compare maps Figs. 12, 13 and 14). The bottomlands along the Red River are also included here because they are of the same type insofar as quail are concerned. This bottomland area includes all or parts of 20 parishes listed in Table 56 along with a complete summary of quail inventory data from each parish.

A study of Table 56 indicates that this large bottomland area contains approximately 2,000,000 acres of quail range all of which is associated with farms. It shows also that the area contains an estimated 19,297 coveys of quail or an average density of 1 covey to 106 acres of occupied range or 1 bird per 8.9 acres. A further breakdown of these data is offered in Table 52. It is apparent from these figures that 29.7 per cent of the area is in quail range which represents 18.0 per cent of the total State range. An important fact is that this area produces only 16.7 per cent of the total State quail population which is considerably less percentage production than in some of the other areas.

Range, Quality, and Limiting Factors:

It is apparent from the statistics presented in Tables 53 and 56 that the alluvial bottomland areas of the State are not producing as well as they should nor as well as they have in the past. A careful investigation of conditions in the area has indicated that deterioration of range conditions as a result of change in land use practices is the basic cause of the reduced quail population here. Hunting pressure is practically non-existent in many parts of this region and cannot be blamed for the low population. Predation by skunks is a factor in some parts of the area, but it is possible that this would be counter-balanced if range conditions were bettered by providing more nesting cover away from ditchbanks where skunks are prevalent.

The primary causes of poor production on this range are the nature of farming and the physical layout of the farms because of the topography and drainage pattern. Because the farm lands run from

TABLE 56

QUAIL INVENTORY DATA – MISSISSIPPI, ATCHAFALAYA, & RED RIVER BOTTOMLANDS

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres per Covey on Range	Pop. Density in Total Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods							
Ascension	192,000[1]	80,000[1]	....	41.6%	0.169[3]	71[2]	0.070[3]	170[2]	1,126	13,512[4]
Assumption	228,480	50,000	....	21.8%	0.060	200	0.013	913	250	3,000
Avoyelles	528,640	160,000	....	30.2%	0.100	120	0.030	397	1,333	15,996
Catahoula (East 1/2)	201,925	60,000	....	29.7%	0.104	115	0.031	387	521	6,252
Concordia	453,760	68,000	....	14.9%	0.104	115	0.015	766	592	7,104
East Carroll	276,480	85,000	....	31.1%	0.182	67	0.055	218	1,268	15,216
Evangeline (East 2/3)	281,311	130,000	....	46.2%	0.190	63	0.085	142	2,063	24,756
Iberia*	252,391	75,000	....	29.7%	0.060	200	0.018	673	375	4,500
Iberville	391,040	85,000	....	21.7%	0.092	130	0.020	598	654	7,848
Lafourche*	318,708	110,000	....	34.8%	0.060	200	0.021	579	550	6,600
Madison	423,680	84,000	....	19.8%	0.142	84	0.027	429	1,014	12,168
Pointe Coupee	360,960	140,000	....	38.7%	0.096	125	0.037	322	1,120	13,440
Rapides (East 1/3)	226,296	100,000	....	44.1%	0.094	127	0.042	287	787	9,444
St. James	159,360	45,000	....	28.2%	0.092	131	0.028	465	343	4,126
St. John	144,000	24,000	....	16.6%	0.092	130	0.015	778	185	2,220
St. Landry	595,200	250,000	....	42.0%	0.120	100	0.050	238	2,500	30,000
St. Martin	472,320	108,000	....	22.8%	0.096	125	0.022	547	864	10,368
St. Mary*	163,809	60,000	....	36.6%	0.060	200	0.022	546	300	3,600
Tensas	398,720	85,000	....	21.0%	0.137	87	0.029	405	984	11,808
West Baton Rouge	123,640	45,000	....	34.9%	0.125	96	0.043	277	468	5,616
Red River Valley**	737,280	200,000	....	27.1%	0.120	100	0.032	369	2,000	24,000
Total	6,935,000	2,044,000	....	29.4%	0.113	106.0	0.033	359.3	19,297	231,564

[1] All figures in these columns represent acres.
[2] Population density in acres per covey.
[3] Population density in birds per acre.
[4] Based on 12 birds per covey.
* Excludes marsh area.
** Includes parts of several parishes.

the crests of natural levees to the woodlands in the rear, there is a poor disposition of forest and open lands with a resulting loss in "edge" and escape cover. In the past years, this was off-set to some extent by thickets left standing in the fields, brushy fence rows, and ditchbanks that formed rows of cover around each 40- to 60-acre block of land. Under the present system with clean farming and cattle production, this type of fence row-ditchbank source of food and cover is all but gone from this area. (Plates 6, 7 and 19).

The primary cultivated crops have never been a great source of food for quail in this area since cotton and sugar cane are not directly utilized. In former years, corn and cow peas as well as other legumes were planted extensively to furnish food for livestock and tenants and as soil restoring rotational crops. At that time, such crops were an important factor in supplementing the natural food supply for quail. In general, however, quail are dependent on the native wild foods that normally grow profusely after the sod is broken. Such plants as partridge peas (*Chamaecrista* spp.), beggar-weed (*Meibomia* spp.), sesban (*Sesban emerus*), ragweed (*Ambrosia* spp.), and the very important false poinsettia (*Euphorbia* spp.), when supplemented by water oak and redgum mast, furnish the bulk of the winter fare of the quail.

Summer foods consist of the various early-seeding grasses, insects, the various types of berries and other fruits.

Modern clean farming methods have seriously affected both the production and location of these principal native foods. Extensive spring and fall plowing, clean ditches and fence rows, the planting of winter cover crops, weed control, and the present practice of cultivating to the edge of the field, have either eliminated or greatly reduced these native plants from wide expanses of farm lands. (See Plates 5 and 6). Greatly increased grazing and cattle production makes much of the area virtually a desert as far as game is concerned. Weeds and native foods are gradually eliminated because the soil is not tilled and most of the underbrush associated with edges is eaten or trampled down by cattle. The result is a reduction of quail carrying capacity on pasture lands by 300 or 400 per cent.

In final analysis, the productivity of the general farm land quail range in the alluvial bottomlands of the State must be judged poor only because of the various land use practices. This area has the most fertile soil in the State, however, and should be producing high populations. This will come about only when some type of quail management is practiced that will compensate for the present shortcomings of the area.

Hunting Conditions and Hunting Pressure:

Hunting conditions in this bottomland area are very poor for two reasons. One is the general low quail population but the more basic reason is the inability of the hunter to get to the birds that are in the area.

Since most of the cover in open fields has been removed, the birds have been forced to confine their range to swamp and dense thicket edges unsuitable for cultivation. Birds, when flushed, disappear into the woods and single shooting is almost a thing of the past in the area. In many instances, even a covey-shot is never attained as the coveys will not hold to the dog until they have moved into the woody thickets at which point the birds may not be seen as they flush. In addition to the normal difficulties of hunting in the area, vast expanses of this land are totally restricted to hunting usually in the name of cattle farming. Probably a greater amount of the available quail harvest is lost to the public because of land restrictions in this area than in any other section of the State.

Since hunting is so unsuccessful throughout the area, it is a foregone conclusion that hunting pressure is low and of little importance in the alluvial bottomlands. In some parishes, particularly in the sugar cane areas, practically no quail hunting occurs.

Future Trends and Recommendations:

The future outlook for quail in this area is not bright. The present land use trends are not conducive to good quail production since landowners, as would be expected, are using every method devised to better their economy. Graph VI shows the changes in quail range acreage in the area between 1940 and 1945. It is clear from this that acreages of all types of crops detrimental to quail production are on the increase and those suitable for quail are decreasing. Pasture lands in particular, have nearly doubled in the five-year period. As this report is being written, preliminary trends showing in the 1950 census, indicate that farm practices detrimental to quail are still increasing.

Recommendations for bettering quail conditions in the alluvial bottomlands are not easily devised. The management practices that would do most for the quail would not be acceptable to the landowners. Following are the methods that should show the most effect, if not so much by an increase in birds, at least by allowing a more equitable harvest to the hunters in this area.

1. The establishment of good farmer-sportsmen relationship would make thousands of acres not now being hunted available to the hunter. The Department of Wildlife and Fisheries, the Louisiana Wildlife Federation, and other interested agencies should sponser some sort of "Hunting By Permission Only" campaign as a step in this direction.
2. The present field-border program should be aimed in this area at getting the birds out where they can be hunted. Food and cover strips that the farmers are willing to plant should be utilized.
3. This area definitely needs research concerned with the land use practices which will be readily acceptable by the land owners.
4. Some sort of compromise with agencies advocating new and clean farming methods should be sought in order to prevent wholesale destruction of natural food and cover. Although cleanliness may usually be desirable, it would seem that when weedy growths and other escape cover do not affect greatly the farm economy, there should be no need of a general removal of it.
5. Simple and economical management practices should be attempted, particularly those that will furnish better conditions for birds on pasture lands. For example, simply plowing or disking strips in pastures should furnish some native food without hurting cattle production. Fencing of cover plots to prevent destruction by cattle should be tried.

It is probable that only such simple economical methods applicable by both land owners and sportsmen groups will ever be applied over the entire area.

QUAIL CONDITIONS IN THE ARKANSAS ALLUVIAL UPLANDS (MACON RIDGE AREA)

The relatively small area in the Macon Ridge might not be recognized by some as being distinct from the general alluvial bottomlands; it is, however, based on a different geological history and does have a different soil formation. (See geological and ecological sections). From an agricultural standpoint, it produces the same crops as the upper Mississippi area but because of certain topographical features that change some of the farming methods, it produces a much higher quail population per unit area than does the Mississippi bottomland region. For this reason, it serves as a perfect example for comparison with the Mississippi bottomland area in order to demonstrate the factors controlling quail populations on intensively farmed areas.

RANGE, POPULATION, AND DENSITY:

The Macon Ridge section has a total area of approximately 1,800,000 acres with some 801,000 acres in quail range. Only six parishes are involved in this area and the range, population, and quail density statistics for each are summarized in Table 57. (See quail map, Fig. 14, for location of area).

An examination of Tables 57 and 53 will indicate several important facts about this small extensively farmed alluvial area. It is immediately apparent that this area is producing quail nearly on a par with the best area in the State. Densities of 1 bird per 5.9 acres on the occupied range or an average of 1 covey per 70.5 acres is unusually good. The area-wide production of 1 bird in 13.4 acres (Table 53) is even more important, particularly when it is compared to the above described Mississippi-Atchafalaya area. Here we have an area where the same crops in about the same proportions are planted yet there is nearly double the quail production on farm lands. (See Graph VI, Table 53).

RANGE QUALITY AND LIMITING FACTORS:

The reason for higher bird production in this area than in other alluvial lands is basically a better quality of range. The cause of this is primarily topographical, however, slightly better soils might cause a greater quantity of foods to be produced.

The same crops and natural foods are utilized by quail in this area as have been listed for the other bottomland area, but the distribution of native food and cover here seems to be much superior for the production of quail. The Macon Ridge is an old abandoned delta of the Arkansas River and its tributaries. Its surface is heavily cut-over by old tortuous channel scar loops which

TABLE 57

QUAIL INVENTORY DATA ARKANSAS ALLUVIAL UPLAND (MACON RIDGE AREA)

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres per Covey on Range	Pop. Density in Total Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods							
Caldwell (East 1/3)	142,888[1]	21,000[1]	........[1]	14.7%	0.187[3]	64[2]	0.027[3]	435[2]	328	3,936[4]
Franklin	414,720	225,000	....	54.2%	0.185	65	0.100	120	3,461	41,532
Morehouse	514,560	200,000	....	38.8%	0.160	75	0.062	193	2,666	31,992
Ouachita (East 1/3)	161,280	25,000	....	15.5%	0.160	75	0.025	484	333	3,996
Richland	368,640	200,000	....	54.2%	0.153	78	0.084	143	2,564	30,768
West Carroll	227,840	130,000	....	57.0%	0.185	65	0.105	114	2,000	24,000
Total	1,829,928	801,000	....	43.8%	0.170	70.5	0.075	161	11,352	136,224

[1] All figures in these columns represent acres.

[2] Population density in acres per covey.

[3] Population density in birds per acre.

[4] Based on 12 birds per covey.

form the basis of the present-day drainage pattern. This pattern consists of brushy ravines, gullies, and small intermittent streams, so breaking up the surface that large plantation type agriculture is not possible. Instead, fields of from 40 to 160 acres are usually the case and, in most instances, they are bordered on three sides by meandering edges of brushy cover and native quail food. The resulting conditions suitable for quail production are obvious. The linear amount of "edge" with its associated natural foods and cover alone is probably three or four times greater per unit area than in the plantation type area. The small fields and the ruggedness of the brushy gullies make the cost of wholesale clearing for clean farming prohibitive. Because of the small size of the fields, more livestock than tractors are used for power. This slows down the clearing process and enhances quail conditions. Better soils in the area are also more conducive to production of greater quantities of food and cover. In final analysis, it is primarily the better distribution of fields and associated cover resulting in a better distribution of food and cover along greater amounts of "edge" which brings about the higher quail populations in this area. (Plate 8)

Hunting Conditions and Hunting Pressure:

Higher bird populations and somewhat greater ease of hunting in the Macon Ridge area bring about better kills. Cultivation up to the many brushy gullies and the increase in pasture, on the other hand, have the same effect here as they do in the Mississippi bottomlands: the birds have to feed on the only food remaining along the strips of thick brushy cover and serious single-bird shooting is prevented. In general, this allows for less enjoyment of the sport. Generally speaking, the number of quail taken in this area, from the standpoint of its effect on population, is not significant.

Future Trends and Recommendations:

The outlook for quail conditions in this area, while not so bleak as for other bottomland areas, is still not good. Like other intensively farmed areas, the farmers in this area are gradually becoming more pasture and cattle conscious and new methods of farming are rapidly replacing the old. Graph VI shows that the changes in this area, particularly the change to pasture lands, have been much greater than even in the Mississippi bottomlands. Because of its topography and cover, this area will produce fairly well until new farming methods reduce the natural foods markedly. This will certainly occur if increased pasturage prevents tilling the soil. It is also within the realm of possibility that a combination of cattle and mechanization will eventually destroy the cover in this area as in the Mississippi-Atchafalaya.

Recommendations for this area are the same as for the Mississippi-Atchafalaya Bottomland areas. (See above).

QUAIL CONDITIONS IN THE NORTHWEST LOUISIANA UPLANDS

The Northwest Louisiana Uplands includes twelve parishes and involves most of the northern part of the State. (See map, Fig. 14). As a quail area it is, at the present time, the most outstanding in the State, having maintained its high populations long after other areas have shown a decline from the peak years around 1920.

RANGE, POPULATION, AND DENSITY:

Although the total area of the Northwest Louisiana Uplands of approximately 5,700,000 acres is slightly smaller than some of the other regions, its 2,500,000 acres of quail range is by far the largest in the State. (See Table 52). Further examination of Table 53 also shows that it is the best quail area in the State having an over-all density of 1 bird to 13 acres, and producing 35 per cent of the total State's quail population. The summary of findings concerning range, density, and population in each of the parishes involved is shown in Table 58.

The estimated total population of some 430,000 quail represents nearly twice as much as produced in any other area. The density of 1 bird per 5.8 acres on the occupied range represents the highest attained in the State and is about the best that can be expected of any large area in the State without intensive management. It is probable that the production here per unit area during former peak populations was not much better than now. Greater range at that time with vast expanses of cut-over woodlands and more cultivation probably created more range acreage in past years. If the present production per unit area and the present range occurring in this area can be maintained, the sportsmen of Louisiana will always have a place where reasonably successfully quail hunting can be obtained.

TABLE 58

QUAIL INVENTORY DATA – NORTHWESTERN LOUISIANA UPLANDS

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres per Covey on Range	Pop. Density in Total Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods							
Bienville	528,640[1]	114,686[1]	63,952[1]	33.7%	0.181[3]	66.2[2]	0.062[3]	177[2]	2,976	35,712[4]
Bossier	538,240	193,628	14,704	38.7%	0.174	69	0.062	178	3,030	36,360
Caddo	576,000	289,152	21,462	53.9%	0.110	109	0.059	201.4	2,860	34,320
Claiborne	490,240	285,000	10,000	60.1%	0.200	60	0.116	103	4,750	57,000
DeSoto	575,360	244,405	....	43.5%	0.154	78	0.065	184	3,125	37,500
Jackson	373,120	106,941	6,310	30.3%	0.225	54	0.067	177	2,104	25,248
Lincoln	300,160	220,486	....	73.4%	0.225	54	0.162	74	4,083	48,996
Natchitoches	830,080	212,067	81,000	35.3%	0.107	112	0.038	316	2,626	31,512
Ouachita (West 2/3)	249,600	120,000	....	48.0%	0.225	55	0.105	114	2,181	26,172
Red River	264,320	169,760	7,940	67.2%	0.143	84	0.096	125	2,116	25,392
Union	579,840	217,618	....	37.5%	0.200	60	0.075	160	3,626	43,512
Webster	400,640	185,826	4,076	47.3%	0.189	63.3	0.090	133	3,000	36,000
Total	5,706,240	2,359,569	209,444	45.0%	0.170	70.4	0.077	156	36,477	437,724

[1] All figures in these columns represent acres.

[2] Population density in acres per covey.

[3] Population density in birds per acre.

[4] Based on 12 birds per covey.

Range Quality and Limiting Factors:

The range in the Northwest Louisiana Uplands represents the best basic quail range that can be hoped for. It is an extensive, somewhat crudely farmed pine hill area.

The distribution of farms over much of the area results in the maximum in "edge" and cover-food relationship. Cotton is the staple money crop, but most of the farms are self-supporting, highly diversified, row-crop farms. Clean farming has not yet markedly affected this area, and pasture and cattle production are just now beginning to increase. There is a wide variety of native foods which grow as a result of tilling these hill soils. These include partridge peas (*Chamaecrista* spp.), beggarweed (*Meibomia* spp.), doveweed (*Croton capitatus*), wild lespedezas (*Lespedeza* spp.), common lespedezas (*Lespedeza striata*), and ragweed (*Ambrosia* spp.). These are in turn, supplemented by a wide variety of mast such as various acorns, beech mast, pine seeds, redbay, and the various fruits and lesser seed-producing trees and grasses. Cultivated crops such as corn, cowpeas, soybeans, and various other grains and legumes are available for utilization throughout the area.

In general, the well-drained nature of the range with its wide dispersal of cover and abundance of food offers the ideal general bobwhite range and is the fundamental cause of the good quail populations in this area.

Even though good range occurs here, there are certain factors which tend to limit quail populations. One of these that has come to the forefront during the past decade is the rapid abandonment of many of the hill farms. When this occurs, there is an immediate sharp rise in quail population because of the various weeds and other native foods that occur during the first 3 or 4 years that farm land is idle. After this time, however, old field pine, persimmon sprouts, and broom sedge roughs rapidly take over the farm and in a short while, it is obliterated as quail range. This finally results in an actual loss of quail population as the total range is made smaller.

Other major factors limiting quail production are the changes in farming methods discussed elsewhere in this report. Clean farms and cattle production have the same detrimental effect in this area as in any others. Their increase in recent years has lowered the productivity of the area to some extent.

Hunting Conditions and Hunting Pressure:

Quail hunting in the Northwest Louisiana Uplands is the best that the State has to offer. The average hunter with run-of-the-mill dogs finds ample birds to keep him busy. Thick cover in some areas prevents the taking of large bags but there is usually ample shooting to be had. Complaints of thick cover and less birds on the abandoned farms have been the only evidence voiced by hunters against the area. As pointed out above, this is to be expected as more and more farms are abandoned.

Hunting pressure in this area is probably the highest of any quail area in the State. Parish by parish sportsmen interviews indicated that there were nearly twice as many bird dogs in this area as in other parts of the State. In addition to this numerous moderate-sized towns are more or less evenly scattered over the area. This results in a rather dense, but even distribution of hunter effort. The cities of Monroe, Shreveport, Ruston, and Minden all add parts of their populations to the hunters of the area. Since all other types of hunting except squirrel are at a minimum throughout this area, there is no doubt that quail catch the brunt of the hunting. Even in the face of this pressure, the area still produces at the highest rate of any in the State; this tends to minimize the effect of hunting pressure on population.

Future Trends and Recommendations:

Although the Northwest Louisiana Uplands is the best quail area in the State, there is ample evidence that the quail are on the decline in the area. An examination of Graph VI will indicate that nearly 500,000 acres of row crops and crops suitable for quail production were lost from the area between 1940-45. Between 1945 and 1950, farm census figures indicate a further 10 per cent drop in the total number of farms. This has resulted in considerable loss of quail range throughout the area and a conversion of much of the area to pasture and cattle production. The result has been and will continue to be a drop in total quail population so long as this trend continues and there is no evidence even that it has yet reached a peak. Here again the game management technician is faced with the problem of finding ways of maintaining quail populations in the face of range destruction brought on by changes in the farm economy and land use practices.

Recommendations for the area include the following:

1. Continue to expand field border programs in order to offset, as much as possible, changes in food and cover.
2. Try to devise some system of management on pasture lands that will produce quail and still be compatible with cattle production.
3. Educate the landowners to retain as much cover and food as possible, with the new system of farming, in order to save some of the quail range.
4. Game technicians should meet with the technicians of farm advisory agencies to work out some means of compromise that will protect farm game as much as possible.
5. Develop better farmer-sportsmen relationships so that more land will be available to the hunters.

QUAIL IN THE NORTH CENTRAL LOUISIANA UPLANDS

This small North Central Louisiana Uplands section is generally the same both geologically and ecologically as the Northwest Louisiana Uplands. (See maps, Fig. 1, 12 and 14). It is placed in a separate section here because of its great lack of quail range which is primarily due to its small acreage of farmlands. It cannot be considered a significant quail area and does not require much discussion.

RANGE, POPULATION, AND DENSITY:

This area, which includes some 1,900,000 acres, is about the same size as the Macon Ridge area but has only about 340,000 acres of quail range. Its quail density per unit area, as in most of the pine hill lands, is fairly high at 1 bird per 6.1 acres of occupied range. The total population, however, is only about 57,000 birds because there is so small an area of available range. In this section, only 18 per cent of the area is in quail range as compared to 43.8 per cent for the Macon Ridge and 45.0 per cent for the Northwest Louisiana Uplands. (See Table 53).

All or parts of five heavily timbered central Louisiana parishes are involved in this section. Table 59 lists these parishes and the summary of quail range, density, and population for each. An examination will disclose that, excepting Grant Parish,

TABLE 59

QUAIL INVENTORY DATA – NORTH CENTRAL LOUISIANA UPLANDS

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres per Covey on Range	Pop. Density in Total Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods							
Caldwell (West 2/3)	207,000[1]	25,000[1]	........[1]	12.0%	0.400[3]	30[2]	0.048[3]	248[2]	833	9,996[4]
Catahoula (West 2/3)	266,555	21,000	8,000	10.9%	0.104	115	0.011	1,057	252	3,024
Grant	428,800	90,000	50,000	32.6%	0.126	95	0.041	294	1,458	17,496
LaSalle	408,320	20,000	29,000	12.0%	0.087	138	0.010	1,150	355	4,260
Winn	608,000	88,825	21,740	18.1%	0.205	58.4	0.038	320	1,900	22,800
Total	1,918,675	244,825	108,740	18.4%	0.162	73.7	0.030	399	4,798	57,576

[1] All figures in these columns represent acres.
[2] Population density in acres per covey.
[3] Population density in birds per acre.
[4] Based on 12 birds per covey.

all of the parishes have a pronounced lack of quail range, some running as low as 11 per cent. It is evident from this fact that no matter how well the limited range produces, it is not extensive enough to be expected to produce significant populations.

RANGE, QUALITY, AND LIMITING FACTORS:

The basic farmland quail range in this area is identical with that of the Northwest Louisiana Uplands insofar as quality is concerned. (See preceding section). Crude hill farms scattered throughout a dense pine-hardwood forest offer excellent range where they exist. The cut-over pineland segment of the range representing about 30 per cent of the total, is somewhat less productive because native foods are less numerous in such areas where the soils are not frequently tilled.

Factors limiting quail production here are generally the same as described in the preceding section, excepting that, in this area, there is the additional dearth of range. Farm lands are so limited in the area that they fail to make up anywhere near the ideal pattern of food and cover distribution with the intervening pine-hardwood areas. This results in a considerable loss of "edge" which reduces the suitability of the area for quail.

HUNTING CONDITIONS AND PRESSURE:

Hunting conditions in this area are not the best because of cover denseness around the farms and the fact that the farms are so scattered and isolated that one has to move about considerably in order to find enough birds to hunt. In general, however, hunters familiar with the area and having access to the farms that are available can find satisfactory hunting.

Hunting pressure in the area shows no indication of having any effect on local quail populations. Although it is somewhat heavy on the open lands, there are enough birds in unhuntable areas to replace any breeding stock loss that might occur from overshooting the open areas.

TRENDS AND RECOMMENDATIONS:

There is little that can be expected of this general area in the way of a significant increase in quail population. It is primarily a timber area that is cut on a rotational plan; farms and open lands suitable for quail will in all probability decrease rather than increase. The bird population on the open farm land that does remain is expected to be rather stable unless cattle production and pasture lands become the primary farm crops.

Recommendations for the area can only be directed toward helping the individual landowner who wishes to raise quail. All aid and advice should be extended interested parties toward the following management practices:

1. The planting of supplemental food strips.
2. The managing of food and cover in order to get maximum production.
3. The controlling of cattle and grazing on quail lands if high quail populations are to be expected.
4. Recognition of the necessity of breaking the soil to insure the growth of native foods.

QUAIL IN THE SOUTHEAST LOUISIANA TERRACE LANDS

The Southeast Louisiana Terrace Lands or "Flordia Parishes" consist of eight parishes lying east of the Mississippi River and north of Lake Pontchartrain. (See maps, Figs. 11 and 14). In bygone days this area was renowned for its quail shooting, and even today it has remained one of the best quail areas in the State, although range and population of the birds have been considerably reduced during the past three decades.

RANGE, POPULATION, AND POPULATION DENSITY:

The Florida Parishes have a total area of some 3,000,000 acres, of which approximately 1,600,000 or 50.4 per cent is in quail range. Most of this quail range is confined to truck crop, dairy, or diversified farms, but nearly half a million acres is denuded pinelands lying primarily in the eastern half of the section.

The average quail density of 1 bird in 6.1 acres in the occupied range and 1 bird in 13.1 acres over the entire area is about the same as for the Northwest Louisiana Uplands and represents the best production attained in the State. (See Table 53). The total quail population estimated at some 230,000 birds probably represents a considerable decrease from former years, yet it is still large enough to offer good shooting. The present reduced population in the area is directly attributable to two factors: (1) the great loss of range in St. Helena, Livingston, Tangipahoa, and Washington Parishes because of extensive reforestation; and (2) the decrease in productivity of the sedge-covered pine barrens and the heavily grazed dairy and beef cattle ranges in the area.

Some of the parishes are more productive than others primarily because they contain greater amounts of range. Table 60 lists the individual parishes, their range, population, and quail density in each.

In general, the present-day population and productivity per unit area in the Florida Parishes is probably near maximum for the current land use practices. The annual harvest is good, but because it is collected by so many hunters, there are usually complaints about small bags and a lack of birds.

RANGE QUALITY, RANGE DISTRIBUTION, AND LIMITING FACTORS:

Quail range in the Florida Parishes may be divided into three basic types and distribution.

1. Range Associated with semi-crude, diversified pine hill farms. This type is primarily located in the Felicianas, St. Helena, and the northern part of Tangipahoa Parishes. It is an excellent high-producing type range but has been reduced by reforestation and conversion to other farm types.
2. Range consisting of cut-over pinelands, extensive pasture land in the dairy and cattle-producing areas, and idle lands. This type of range is lacking in food in all areas and may be lacking in cover if grazing is extensive. Its productivity is much below that of the diversified farming areas and a noticeable decrease from former high quail population has occurred. The denuded pine portion of this range is primarily located in the southern part of Washington, St. Tammany, and the eastern part of Tangiphoa Parishes, while the pasture and idle lands are found in the Felicianas, East Baton Rouge and Tangipahoa Parishes.
3. The remainder of the range is confined to small strawberry and truck farming scattered over most of the Florida

TABLE 60

QUAIL INVENTORY DATA – SOUTHEAST TERRACE LANDS (FLORIDA PARISHES)

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres / Covey on Farm Range	Acres / Covey on Pine Land Range*	Pop. Density in Total Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods								
E. Baton Rouge	295,680[1]	102,000[1]	....	34.4%	0.200[3]	60[2]	......	0.069[3]	174[2]	1,700	20,400[4]
E. Feliciana	290,560	182,400	....	62.7%	0.250	48	......	0.157	76	3,800	45,600
Livingston	425,600	83,000	....	19.5%	0.250	48	......	0.048	246	1,730	20,750
St. Helena	268,800	110,479	10,000[1]	44.8%	0.210	54	200[2]	0.094	128	2,096	25,152
St. Tammany	581,120	109,637	210,000	55.0%	0.074	120	200	0.041	296	1,964	23,568
Tangipahoa	513,920	189,621	161,704	68.3%	0.117	72	200	0.081	149	3,441	41,292
Washington	425,600	216,728	37,000	59.6%	0.218	49	200	0.130	92	4,608	55,296
West Feliciana	262,400	134,000	....	51.0%	0.147	81	......	0.075	159	1,641	19,698
Total	3,063,680	1,127,865	418,704	50.4%	0.162	60	200	0.082	146	20,980	251,756

[1] All figures in these columns represent acres.

[2] Population density in acres per covey.

[3] Population density in birds per acre.

[4] Based on 12 birds per covey.

*Cut-over pine land.

> Parish area, but centered in the Livingston-Hammond area. Quail production is good but the farmed areas are small and usually surrounded by dense woodland and thick cover. Strawberry farmers in particular, considering the quail detrimental, trap and poison them as much as possible in the spring.

In general, the quail range in the well-drained, rolling, pine-hardwoods hill lands of this section is as good as in most regions of this State. It is believed to be producing at its maximum capacity under present land use practices, but is definitely not producing as well as it did in former years.

The primary limiting factors are the ones brought about by changes in land use. These have been the primary reasons for the gradual decline in population. There are three basic factors operating in this area against the production of quail food and cover. They are:

1. A loss of the once highly productive cut-over pinelands as they reach a stable condition of sedges and wire grass. Food in such areas is at a premium although cover remains good.
2. The great conversion from diversified hill farms to dairy and beef cattle production. The areas involved in this change have lost both food and cover and probably show the greatest decline in birds during recent years. Graph VI indicates that this conversion to pasture land between 1940-45 has been more than double and all indications are that the 1945-50 change will be even greater.
3. The third factor limiting bird production is the loss of range due to reforestation. This has been particularly noticable in Livingston and St. Helena Parishes and in sections of the pine barrens that have been planted. Once excellent quail areas are now solid second-growth forests and more areas are being lost to this cause every day.

Aside from the above basic limiting factors, there are few others that permanently affect quail in this area. Forest fires, weather conditions, and other factors may affect local or annual populations but a sufficient breeding population is always available to restore maximum production when conditions return to normal. Predators show no evidence of affecting the birds. Some complaints of fox predation are heard and high fox populations do occur, yet the quail production remains as high as any in the State.

Hunting Conditions and Hunting Pressure:

Hunting conditions throughout the more open lands are as good as in any place in the State or, for that matter, in the Southeastern United States. The Felicianas are noted for quail hunting and bird dog field trials. In certain areas where hunting was formerly excellent and easy, brushy growth now makes the taking of large bags more difficult. However, probably the biggest detriment to general public hunting in this area is the excessive posting of lands and the leasing of the hunting rights on large areas by small groups. This causes the mass of public hunters to be crowded into a relatively small area and necessitates a division of a limited portion of the annual harvest among a great number of hunters. The results of course, are small bags and a general dissatisfaction with quail conditions.

Hunting pressure in this general area is as high or higher than any place in the State, yet it does not seem to affect the total production of the area. One specific area known to be heavily hunted every year was studied over a 3-year period. A discussion of this study will serve to illustrate the manner in which hunting pressure is noticeable in the area. In this case, a group of negro farms interspersed over some 1,000 acres of pine hill lands, formed what might be described as the best type of unmanaged quail range. The over-all production was approximately 1 bird to 5 acres; each fall for a 3-year period some 18 to 20 coveys were on the area with a total population that averaged nearly 200 birds. About 12 of the coveys were easily shot; the remainder were more difficult to handle. Since these negro farms were not posted, the area was subject to extensive hunting. Usually several hunting parties during the first week of the season managed to take from 50 to 75 birds or some 40 per cent of the total population. In succeeding weeks hunters combed the area and fewer and fewer birds were taken per hunt until finally the hunters gave up in disgust. Checks later in the season indicated 2- and 3-bird coveys and these were difficult to find. Because the bulk of the population was harvested during the first week of the season each year the area was considered shot out by the hunters.

Nevertheless, these same hunters returned to hunt this supposedly shot out area each fall. In this case, pre-season censuses proved that each fall the population reached a maximum despite the fact that most of the birds had been killed on the area the year before. Apparently, this area produced an expected harvestable surplus of birds, but the division of the harvest among so many hunters left most of them feeling that there were not many quail produced. The conditions existing in this small area illustrate clearly what is happening in many places. The land is producing a good supply of quail regardless of hunting pressure, while the kill per hunter and general hunter satisfaction is purely a function of the number of people hunting the area per season.

Trends, Potential, and Recommendations:

The general quail population in the Florida Parishes has decreased as pinelands became covered with sedge and wire grass and pasture lands replaced the diversified row-crop farms. Unless this change in land use slows or stops, the downward trend of the quail population can be expected to continue at a rate proportional to the change. Graph VI indicates that pasture lands are increasing rapidly at the expense of row crop farms. The pasture acreage between 1940-45 doubled and it is expected that the change from 1945 to 1950 was even greater. Unless some management methods are devised to offset this great increase in grazed lands, quail populations will continue to decrease.

The quail-producing potential of the area is good but a maximum will never be obtained under present land use practices. The success of modern farming methods and the great amount of cattle and dairy production make it unlikely that any change will occur in the farming structure that will be beneficial to the quail. Field borders and a manipulation of native and planted cover would help considerably if they could be made compatible with cattle farming. The best place for increasing production in this area is in the 400,000 acres of cut-over pinelands. The management of such pinelands will be discussed in the next section.

Recommended management practices to maintain and, if possible, to increase the quail populations of the area are as follows:

1. Plant food strips and protect as much natural foods and cover as possible on the grazed areas. This will be an ex-

pensive process unless quail foods not palatable to cattle can be developed.

2. Increase food planting and educate landowners to prevent destruction of natural foods and cover on the farm lands of the area.
3. Manage the cut-over pinelands by strip planting of foods. There is evidence that a simple breaking of the sod by disking is also helpful.
4. Establish a better landowner-hunter relationship that would allow more public hunting on private lands. This alone would do more than anything else for better public hunting in the near future.

QUAIL IN THE SOUTHWEST LOUISIANA TERRACE LANDS (SOUTHWEST LOUISIANA PINELANDS)

The cut-over longleaf pinelands of the Southwest Louisiana Terrace along with the barrens in the Southeastern Terraces and other parts of the State are unique in their relationship to quail production. The southeast and southwest Louisiana pinelands at one time produced some of the finest quail shooting in the United States, yet at the present time, they are some of the poorest quail producing areas in the State. The story behind this change in quail production lies in the ecological changes that have occurred in these cut-over pine areas. Farm lands in the longleaf pine sections have never been a significant part of the quail range because of the small number of farms able to remain in production on the poor soils.

Range, Population, and Population Density:

The total area of the Southwest Terrace section is some 3,400,000 acres, and will be found to include all of the southwest Louisiana longleaf pine area. (Compare quail and timber type maps Figs. 12 and 14). Of this total area, some 2,000,000 acres or 58 per cent of the section is occupied quail range which consists of 590,000 acres of farm lands and 1,400,000 acres of pine barrens and scantily reseeded longleaf pine lands. This quail range plus the remainder of the cut-over pine lands in the State, (Table 53), is the poorest producing range in the State, yet on the other hand, it is believed that these lands may be the place where game management can do the most to enhance public quail hunting.

At the present time, the pinelands in this and other areas are producing at the rate of 1 bird in from 20 to 30 acres, depending on the fertility of the soils and other factors. (See Tables 53 and 61). Farm lands in this area have an average production of about 1 bird in 10 acres. Those farms on hill tops and without cover drop to the status of the cut-over lands.

Table 61 lists the range, density, and total population by parishes in the area. The present estimated total population of 125,000 birds in this area is belived to represent not more than 45 per cent of the peak population that existed here at one time and it is possible that it may be only 10 per cent of the peak.

At the present time, the area as a whole is producing only 10 per cent of the State's quail population on 19.4 per cent of the total range. (See Table 53). This is a clear indication that the productivity of the available range is not as good per unit area as on other areas in the State.

RANGE QUALITY AND LIMITING FACTORS:

Range qualities and their changes have been the governing factor in the disappearance of quail from the cut-over pinelands. To fully understand these changes, it is necessary to review the details of the ecological history of the area.

In the virgin condition, this area was covered by a majestic park-like stand of longleaf pine interlaced by an intricate pattern of small "green heads" and spring creeks which formed the drainage pattern. The soils were poor and extremely sandy but several hundred years accumulation of leaf mold and duff had made a thin but fertile top layer on the forest floor. The lumber companies later clear-cut all of the timber except scrub hardwoods along creeks: the result is a vast barren area threaded by brushy creeks. (Plates 16, 17, 18, 20 and 21). At the time of cutting, pine tops were left to litter the hills and to burn with raging fires.

In the virgin forests, quail populations were at a minimum because of the lack of a bountiful food supply in the clean, park-like understory. After the trees were cut, the thin layer of rich topsoil, with the increased sunlight, produced a wide variety and an abundance of suitable foods for quail. These included partridge peas (*Chamaecrista* spp.), wild lespedezas (*Lespedeza* spp.), beggarweed (*Meibomia* spp.), butterfly peas (*Martusia* spp.), milk

TABLE 61

QUAIL INVENTORY DATA – SOUTHWEST TERRACE LANDS (SOUTHWEST PINE LANDS)

Parish	Total Area	Approximate Quail Range		Percent of Parish in Quail Range	Pop. Density on Range	Acres / Covey on Farm Land Range	Acres / Covey on Pine Land Range***	Pop. Density Parish	Acres per Covey in Total Parish	Total Coveys in Parish	Total Birds
		Farms & Associated Lands	Cut-over Pine Woods								
Allen	496,000[1]	93,000[1]	201,560[1]	59.3%	0.061[3]	100[2]	300[2]	0.036[3]	330[2]	1,501	18,012[4]
Beauregard	757,760	130,000	414,475	71.8%	0.059	100	300	0.042	282	2,681	32,172
Evangeline*	148,769	25,000	54,000	53.1%	0.065	100	300	0.034	345	430	5,160
Rapides**	483,870	100,000	222,660	66.6%	0.064	100	300	0.043	277	1,742	20,904
Sabine	658,560	146,000	95,000	36.5%	0.088	100	300	0.032	370	1,776	21,312
Vernon	870,400	100,000	376,307	54.7%	0.056	100	300	0.031	386	2,254	27,048
Total	3,415,359	594,000	1,394,002	58.2%	0.062	100	300	0.036	328	10,384	124,608

[1] All figures in these columns represent acres.
[2] Population density in acres per covey.
[3] Population density in birds per acre.
[4] Based on 12 birds per covey.

* Northwest 1/3 of parish.
**West 1/2 of parish.
*** Cut-over pine land.

peas (*Galactia* spp.), ragweed (*Ambrosia* spp.), dollar peas (*Rhynchosia* spp.), noseburns (*Tragia* spp.), beakrushes (*Rhynchospora* spp.), nutrushes (*Scleria* spp.), and various seed-producing grasses. In addition to these, the drupe of the redbay, the various scrub oak acorns, pine mast, and miscellaneous seed were used. It should be made clear at this point that these same foods occur in the area at present, but it was a matter of quantity that caused the quail population to soar in freshly-cut pine areas. In days of peak population it was not uncommon to see whole hill sides covered with partridge peas after a burn; native legumes and other food producing plants were abundant. At the present time, these plants have been crowded out by various perennial grasses that are a product of normal plant succession. Two of the more important groups of perennial grasses in this respect are the bluestems (*Andropogon* spp.), with several species including the broom sedges, and muhly (*Muhlenbergia* spp.). Plants of these two genera not only crowd out quail food plants but form roughs too dense for quail (Plate 21). This succession of plants occurs in a cycle of 8 to 10 years after cutting so that by the mid-twenties most of the pinelands were rapidly reaching a condition where wire grass and broom sedges were dominant. At this point, quail populations started downward to reach a very low but stable condition by the nineteen thirties.

Present range conditions in the pine barrens indicate that the quail are surviving on a minimum food supply scattered along "green-head" spring branches, and on the widely dispersed legume crop that occurs after burns and on hillsides that have only thin growths of grass. Of great importance at the present time are the various fruits, drupes, and mast, and the greater quantities of legumes that grow around old, abandoned farms and house sites.

Farmland range in this area is typical of the diversified hill farm and is excellent except where farms on the very tops of barren hills fail to have enough cover to protect quail.

The basic limiting factor to quail in this pine barren area is definitely a shortage of food and this, coupled with a lack of cover even where many foods do occur, does not enhance the quail population at all. As outlined above, most of the food shortage is a result of poor soils and a part of a normal ecological cycle but several other factors secondarily affect the food and cover supply and these are the ones that can be more readily changed in order to aid quail production. These may be listed as follows:

1. *Fires*: Fire is an important limiting factor both by its presence and absence. Uncontrolled hot fires at the wrong time of year ruin nests, kill young birds, destroy food plants, and ruin cover, (Plate 20). On the other hand, a lack of fire allows high, impassable roughs to destroy all food and makes the area virtually unusable to ground-feeding birds. (Plate 21). *Fire when properly controlled aids in the production of legumes and various seed-producing weeds and probably is the simplest, most economical method of managing quail in the cut-over pinelands.*

2. *Open range grazing by cattle*: Heavy grazing, in this area of poor food, probably results in direct competition between cattle and quail for the choice legumes. Furthermore, food planting in the area as a means of management can never expect to be economically sound as long as mineral-starved cattle range freely over the area. There is some evidence, however, that light grazing in the area may aid quail habitat conditions by increasing the amount of common lespedeza.

3. *Cover shortage*: Although ample cover occurs along the various drainage patterns, there is none on hill sides or tops where much of the food occurs. This, in effect, limits the effective portion of the range to only a fraction of the total. (Plate 16).

HUNTING CONDITIONS AND HUNTING PRESSURE:

Hunting conditions from the standpoint of the ease of hunting are ideal in the area. Practically all of this land is unfenced and open to the public. Cover is not dense enough to hamper shooting or dog work and the hunter is able to wander for miles along the various draws and over hills at will. The low bird supply in the area necessitates considerable walking or horseback riding to get limit kills but statistics collected by Perkins (1950) indicate that diligent hunting will supply good kills. From all standpoints, even with the lowest quail populations the cut-over pinelands offer the best and probably the only true public shooting areas. In the opinion of this investigator, it is here that the smallest amount of management would do the public hunter the most good.

Hunting pressure in this ecological section is at present only moderately high. The reason for this is the remoteness of some parts of the areas which prevents excessive hunting by large numbers of hunters. The other is the tendency for all hunters to confine their hunting to areas where most of the birds occur or which appear to be good quail range. Other areas presenting a poorer type of range and with perhaps fewer birds are seldom if ever hunted yet many contain huntable populations. In three years of census work and general hunting of the area, few hunting parties or signs of hunting were encountered.

In this area, as in the Southeast Terrace Lands, a study of several heavily-hunted, well-populated areas failed to show any effect of hunting pressure on the peak population from fall to fall. As in other areas, however, heavy hunting here is noticeable early in the season as smaller coveys occur and they become harder to find. There is no evidence, however that such hunting reduces the population permanently, and, in this area, a census of certain army lands where hunting was prohibited for over seven years showed identical preseason populations with heavily hunted neighboring lands.

TRENDS, POTENTIAL, AND RECOMMENDATIONS:

The cut-over pinelands of Southwest Louisiana and for that matter pinelands all over the State represents the only places where quail populations seem to be truly stable.

It is evident that the lowest point of production in these areas was reached some time ago and that it has and will remain at this point under present conditions. The only foreseeable factor that could further reduce populations in the area would be large scale and dense reforestation. Light scattered pine and scrub oak forests offer better quail conditions than completely barren lands. Because almost any increase in food supply in this area should cause an increase in quail and because the area is best suited for public hunting management, it is believed that every effort should be made to begin work here. Certainly even the least and most economical effort would get greater results in this area than in any other in the State. Following are some recommendations that should greatly aid the quail conditions if put into effect on the pinelands of the State:

1. *Management for increased food supply:* There are several methods that should give good results in increasing food, some more economical than others.

(a) The most economical methods to get some increase in foods, not necessarily a maximum, would be the elimination of heavy grazing and the practice of controlled burning over large areas to get the best distribution of the presently available food and cover.

(b) It is clear that once soils are broken in this area, the return to a perennial grass rough occurs only after very long periods. Old fields abandoned 20 or 30 years ago still produce more native foods than areas where the sod was never broken. A careful survey of the areas indicates that at least one covey of birds is usually associated with such areas. It is believed that it would be economically sound to disk long strips and, in effect, prepare the equivalent of abandoned fields by breaking the sod. This should greatly increase the food supply without the use of seed or fertilizer except as an initial planting for a source of seed plants.

(c) The fertilizing and planting of quail foods would greatly increase the population as has been demonstrated on various State refuges. This system, however, is more costly and, to be successful, demands the absence of cattle. The planting of common lespedeza, even if cattle are present, would be successful to a considerable extent.

2. *Manipulation of cover:* Although cover is good in scattered areas and along all drainage patterns, thousands of acres of bare hill lands are not being used because of a total lack of cover. (Plate 13). Some management practices that could be introduced to increase cover are as follows:

(a) The establishment of cover plats by topping or breaking over trees and the planting or nurturing of native cover such as scrub oak thickets.

(b) The planting of exotic plants like multi-flora rose and the establishment and maintenance of various native, berry-producing briars that could serve as food and cover. If a plant were found that could be readily established in the area, a definite food-cover distribution pattern could be worked out that would increase the covey range considerably.

3. *Investigation and demonstrations:* There is a definite need for investigation toward a sound and economical management plan for the area. This should involve a search for the new foods and

cover, and simple ways and means of increasing and bettering the distribution of native foods and cover. The methods devised should be fully demonstrated to the public so that sportsmen's groups and landowners could put them into practice as they become interested.

QUAIL IN THE PRAIRIE LANDS AND COASTAL MARSHES

The Southwest Louisiana Prairie Lands and the Coastal Marshes are not considered to be suitable for significant amounts of quail production or management. It is being discussed here only in order to discuss completely all sections of the State with regard to quail.

Range, Population, and Density:

The Coastal Marsh and Prairie Lands together consist of a large total area of 6,700,000 acres. The lands that might conceivably be considered quail range here are approximately 1,100,000 acres, most of which is in rice production and cattle pasture in the prairie section.

The total quail population of both these sections and the general production per unit area is shown in comparison with other areas in Table 53. The production of the various parishes in the sections is compared in Table 62. It is clear that the production at the rate of 1 bird in 177 acres over the whole area is by far the lowest in the State. The estimated total population of 38,000 quail is too low to furnish successful hunting and prevents these sections from being placed in the catagory of good quail areas.

Range Quality and Limiting Factors:

The extremely poor quality of the range as quail habitat is the sole cause of the lack of birds. Nature left this prairie country without any suitable cover such as woodlands or brushy areas. Man's use of the area as a vast rice field and cattle pasture precludes any thought of seriously expecting quail to exist there. The coastal marshes, except for a few wooded or farmed ridges, are either too wet or deficient in cover to support quail. In east Louisiana, the coastal marsh and other associated areas have a minimum of range in the form of truck and dairy farms.

The limiting factors for quail are obvious. There is little or no protective cover, and an annual food supply is greatly disrupted by

TABLE 62

QUAIL INVENTORY (ESTIMATED) COASTAL MARSHES AND PRAIRIE AREAS

Parish	Total Area	Approximate Quail Range	Per cent of Parish in Quail Range	Pop. Density on Range	Acres/Covey	Pop. Density Total Area	Acres/Covey Total Area	Total Coveys in Area	Total Birds
Acadia	423,680	260,000*	61.3	0.026[2]	450	0.016[2]	734	577	6,924[3]
Calcasieu***	535,216	100,000	18.7	0.026	450	0.004	2,410	222	2,664
Cameron	924,160	100,000	10.8	0.026	450	0.002	4,162	222	2,664
Iberia	(1)	(1)							
Jefferson	261,760	8,000	3.0	0.060	200	0.001	6,544	40	480
Jeff. Davis	421,120	250,000	59.3	0.026	450	0.015	758	555	6,660
Lafayette	181,120	140,000	77.2	0.080	150	0.061	194	933	11,196
Lafourche	(1)	(1)							
Orleans	127,360	3,000	2.3	0.060	200	0.001	8,490	15	180
Plaquemines	629,760	30,000	4.7	0.020	600	....	12,595	50	600
St. Bernard	326,400	10,000	3.0	0.020	600	....	19,200	17	204
St. Charles	194,560	25,000	12.8	0.060	200	0.007	1,556	125	1,500
St. Landry**	115,200	60,000	52.0	0.026	450	0.013	866	133	1,596
St. Mary	(1)	(1)							
Terrebonne	890,240	60,000	6.7	0.026	450	0.001	6,693	133	1,596
Vermilion	783,360	100,000	12.7	0.020	600	0.002	4,719	166	1,992
Total	5,813,936	1,146,000	19.7	0.033	359	0.006	1,823	3,188	38,256

* All figures based on published farm acreages but because of the scarcity of cover must be considered a very liberal estimate of occupied range.

** West 1/5 of parish only.

*** Includes only 4/5 of parish.

[1] Quail lands included in another section.

[2] Birds per acre.

[3] Based on 12 birds per covey.

cultivation and flooding the rice areas. In fact, there is practically no quail range in the area, but where range does occur, some quail are present.

Potential and Recommendations:

Since populations are so low, quail hunting is practically non-existent and, in general, will never be a major sport of the area. Because of the general condition of a range without cover and the inability to establish such there, few if any recommendations can be offered for the area as a whole. To individual landowners who wish to attempt to increase or produce quail on their lands, the recommendations suggested for the barren pinelands may be used. (See Section above). The initial step will be to establish a food and cover pattern suitable for quail. This can be done if cost is not a factor or if only attempted on a small scale.

Mourning Dove

The eastern mourning dove (*Zenaidura macroura carolinensis*) is an abundant and popular game bird in certain sections of Louisiana. Periodically, however, Louisiana and the other Southeastern States experience a marked decline of this bird. The exact cause of the decreases in population of this migratory bird over the Southeast is not known. Gun pressure, disease, poor breeding years, weather conditions, and changes in food conditions are all suspected; some are favored by one authority and some others. The migratory nature of the dove, the difficulty of tying-in factors from various regions, and the size of the problem have prevented any one authority from determining the answer to present dove conditions. In 1949, however, a cooperative dove study involving 12 of the Southeastern States was started. This work, to be completed in 1952, is being coordinated and directed by personnel of the United States Fish and Wildlife Service stationed in Atlanta, Georgia. Louisiana is taking an active part in this study. The field work is being directed by Mr. John D. Newsom, biologist for the Federal-Aid section, Louisiana Department of Wild Life and Fisheries.

Since it is the purpose of this report to develop and present the latest understanding of game conditions in Louisiana, clearly defined preliminary findings on the presently active dove project are being included in this section. For this information, we are indebted to Mr. Newsom and his assistant.

LIFE CYCLE AND ECOLOGY OF THE DOVE IN LOUISIANA

The mourning dove, a relative of the once-numerous passenger pigeon, is a medium-sized bird prized both for its table delicacy and its ability to put the best wing shots to test. Although the mourning dove is a migratory bird congregating in the Southern States and Mexico during the winter months, a large number of these birds breed in Louisiana and remain here throughout the year.

The life cycle of the dove in Louisiana is essentially the same as determined by Moore and Pearson (1941) in Alabama. Mating may start early in the spring as flocks break up and the majority of the birds start their northward migration. Many birds pair off and nest locally with the peak of nesting in Louisiana occuring in June. Nesting continues into the fall and some young birds are still in the nest during September and October. Because the dove lays only two eggs per nest, its actual breeding potential is not generally considered to be as high as that of the quail and other birds. However, in Louisiana, as in other sections of the South, it has been found that doves may have several successful nestings per year and in some cases young birds hatched early in the spring may themselves breed by late summer. This factor of multiple nesting per season plus the fact that a high prcentage of nests are successful would indicate a higher breeding potential than might be expected.

During the summer breeding pairs may be found all over the State except possibly in the coastal marsh and in the center of the dense swamps and forests.

Although Moore and Pearson (1941) found the dove to prefer pine trees as a nesting site, recent findings on the dove projects in Louisiana and other states tend to indicate that doves make use of whatever trees are available and suitable in the ecological types that they happen to occupy.

Generally the dove is distributed over most of the State, but the fact that it feeds almost exclusively on grain and weed seeds makes it primarily an inhabitant of farm and associated lands. This is particularly true of the fall and winter period as the local birds gather in flocks and are joined by other flocks migrating from the north. During such times, areas of intensive agriculture become the primary range of the dove.

RECENT HISTORY OF DOVE CONDITIONS IN LOUISIANA

All indications are that wintering dove populations reached a peak in Louisiana along with quail between 1910 and 1925 during a period of extensive, semi-crude, row-crop agriculture. Doves in general flocked in all of the freshly harvested farmlands of Louisiana during the fall but vast flocks and heavier concentrations were much more common in the extensively farmed alluvial bottomlands along the Mississippi, Atchafalaya, and Red Rivers. (See map—Fig. 12.) In such areas, large plantation-type farms with extensive acreages of corn, grain, and legumes planted both in rotation and as livestock food, idle weed fields resulting from the rotation farming, and unclean, weedy, row crop fields all furnished maximum amounts of food and attracted doves by the thousands. It was in such areas that dove hunting was most popular and these game birds were bagged by the thousands. It is interesting to note at this point that although bag limits were often exceeded in Louisiana, the large mass hunts over baited fields common to some other parts of the South apparently were never attempted extensively in this area.

Although dove populations and hunting reached extremely high proportions in the alluvial and prairie areas of the State, this was never quite true of the small, more scattered hill farms. Except in the few intensively farmed sections of north Louisiana and the Florida Parishes, dove hunting has always been at a minimum over most of the pine hill areas. Quail hunting in such areas is of such excellent caliber that dove hunting is of little consequence.

Dove hunting in general remained good in the State until the late nineteen thirties; since that time there has been a decline in populations and a certain amount of shifting of the general location of wintering populations in Louisiana. This has resulted in the elimination of any large amount of dove-hunting by Louisiana hunters except in the rice area of the Southwest Prairies and to some extent the Macon Ridge and the Red River Valley. The general decline in doves is being felt over the entire Southeast and is causing considerable furor in states where dove hunting is a major sport. In Louisiana, the decline has been marked and no doubt has contributed to the generally poor dove hunting conditions but the decrease in doves has not been great enough to explain the virtual absence of birds from areas which once furnished the best shooting in the State. This point will be examined in some detail futher in the report: there is evidence that the absence of doves in the alluvial areas is not simply a result of the general lowering of the national population.

LOCAL DISTRIBUTION AND MIGRATION

As pointed out above, doves in general may be found over the entire State particularly during the breeding season. This is quite as true now as in the past but local movements of doves, particularly during the fall and winter, have always made certain areas more densely populated than others.

There is evidence of three distinct phases of movements within the State. These may be listed as: (1) the flocking and migration of locally raised birds; (2) the arrival and departure of the northern-reared birds; and (3) the local shifting of winter concentrations or populations because of food and weather conditions.

The migration of locally-reared birds has long been apparent to north Louisiana sportsmen. They claim that to kill local doves they must have a season in September or October before the doves leave the northern part of the State. Some evidence supporting this fact was gathered on this project and Newsom (1950-51) working on the dove project has found that such a movement does occur. Apparently locally-reared doves form flocks in north and central Louisiana during August and September, feed locally for a time in the fields, and leave the area completely some time in late September or early October. Band returns from birds trapped in and out of the State indicate that these birds move southwestward into the rice lands of Louisiana and into Texas.

It would seem logical that birds reared just north and east of Louisiana would replace the local doves after they move out, but apparently this is not the case. Birds banded in the State of Mississippi evidently fly beyond the northern and eastern parts of Louisiana into Southwest Louisiana and Texas in their southwestward movement.

The arrival of northern birds in the State does not occur until late in November or early December. This means that there is nearly a 2-month period during October and November when much of Louisiana is devoid of a dove population. The northern birds more or less blanket the State but under present conditions tend to concentrate in the more intensely agricultural areas of the Macon Ridge, the north central hill parishes, and the southwest pinelands. Occurrence of doves on the plantations of the river bottomlands is sporadic and is apparently controlled by farming methods and food. In former years most of the doves used these areas, but in recent years, particularly in the southern section of the Mississippi Alluvial Plain, doves have not been abundant. Most of the northern birds start to move back north in January and by March almost all of them are gone and local birds are pairing off.

Food and weather conditions apparently play a part in the local movements of doves. Large concentrations always are associated with extensive and well-supplied feeding areas. Doves, however, will leave a feeding area even before all of the food is utilized because of heavy hunting, or normal migratory habits.

It is possible that dove movements in Louisiana are rather definite as to time, direction, and place. In order to manage this game bird and particularly its harvest, the times of the various movements should be carefully considered.

PRESENT POPULATION AND POPULATION DISTRIBUTION

This inventory attempted only to determine the distribution of populations and the presence or absence of enough birds to constitute a shootable population. Newsom (1950-51) on the dove project with the aid of other Pittman-Robertson personnel made a dove census in February 1950 and, at the same time, attempted to devise a standard method for indexing populations. In the latter case, the number of birds seen per 100 miles by rural mail carriers and on controlled road counts by project personnel were used. The results of the 1950 inventory are shown in Table 64.

The total number of doves remaining in the State after the 1949-50 hunting season was some 2,400,000, as indicated in the above table. The accuracy of the total figure, of course, is questionable

TABLE 64

RESULTS OF DOVE CENSUS
(Current dove project)*

Ecological Type**	Total Area**	Acres Censused	Doves Seen	Acres Per Dove	Total Population
Northwest Louisiana hill-lands-pine-oak-hickory	7,098,240[1]	7,200[1]	275	26.20	271,121
Upper Mississippi, Tensas, Ouachita bottomlands	5,069,025	4,340	500	9.28	546,223
Southwest Louisiana Terrace Lands (Cut-over pine)	3,304,960	2,880	46	62.60	52,794
Prairie and marsh area	2,009,600[2] 5,881,440	1,820[2] 1,820	000 450	000[2] 4.04	000[2] 1,455,802[2]
Lower Mississippi Atchafalaya Bottomlands	2,911,613	800	12	66.60	43,718
Southeast Terrace Lands (Florida parishes) Pine-hardwoods	3,363,680	3,040	74	41.00	74,724
TOTAL	29,338,558	21,900	1,357	16.13	2,444,382

* Compiled by Newsom (1950)

** These figures based on ecological boundaries set for dove study. They do not necessarily conform exactly to the boundaries used throughout this inventory work but are essentially the same.

[1] All figures in acres.

[2] The marsh and prairie figures are combined because, through error, part of the prairie was censused as marsh. In all probability, the 4.04 acres per bird should be applied only to some 2,350,000 acres of prairie land, indicating a population in the area of 581,683 instead of 1,455,802.

because so small a sample was taken. A statistical analysis of this method indicates that the amount of error involved is so great that the actual population might be anywhere between 600,000 and 2,500,000. Regardless of the accuracy of the total figure, the relative populations of the various ecological regions are of considerable importance. It becomes reasonably clear upon examination of the 1950 census figures that the lower Mississippi-Atchafalaya, the Florida Parishes, and the cut-over pine areas do not support large enough segments of the dove population to afford successful hunting. The Northwest Louisiana Uplands has too few doves to furnish good hunting when the size of the area involved is considered.

There is no way to compare present populations with those of the past. If hunter success is considered the criterion, there has been a great decline in doves and years past must have seen this State with a population of 10 or more million birds. Hunter success may be misleading in this case because those areas in which doves used to concentrate in large flocks, and where the majority of easy hunting occurred are the ones now containing so few birds that hunting is impractical. At the present time birds are using small diversified farms rather than plantations. This results in smaller flocks, more difficult hunting, and small kills in proportion to the total doves in the area. Since large bags are somewhat harder to make because of the change in feeding areas the actual population decline in Louisiana may not be as large as the hunter success indicates. Whether the decline has been great or small does not explain the great lack of birds on the plantations of the bottomlands. More likely a lack of food resulting from land use changes has brought about the great drop in numbers of birds using those areas.

A comparison of the index of population found in Louisiana with other southern States indicates that the population per unit area is much the same in most instances. For example, the average number of doves seen per 100 miles by rural mail carriers ranged from 14.1 in Florida to 21.4 in Alabama, making an average of 16.95 for the states of Georgia, Tennessee, Florida, Alabama, Mississippi, and Louisiana. (See Table 65).

TABLE 65
COMPARISON OF DOVE POPULATION INDEXES

	La.	Miss.	Ala.	Ga.	Tenn.	Fla.	Average for Southeastern Region
Average No. Doves Seen/100 Miles	17.6	18.0	21.4	17.0	17.75	14.1	16.95

It would seem evident from these studies that dove populations in Louisiana are essentially the same as over the remainder of the southeast and that the answer to the problem of the decline in dove numbers must be determined from an area-wide study. No final conclusion can be drawn from the cooperative dove study thus far, but such an investigation will produce the necessary information as more data are collected from the entire area.

RANGE AND RANGE QUALITY:

The actual winter range of the dove in Louisiana is approximately the same as that for quail. Since the dove does not require such close escape cover as the quail, it is likely that they are able to utilize slightly more of the farming area as range. There are approximately 7,400,000 acres of cultivated and open lands on farms suitable for utilization by doves, plus an additional 2,800,000 acres of farm wood lots. Table 53 shows the break-down of the amount of range by ecological types. For an approximate break-down by parishes see quail tables 56-62.

It will be seen from the above table that only four ecological regions contain enough dove range to be of significance. These may be described separately as follows:

Lower Mississippi-Atchafalaya Alluvial Plains

This area, once an excellent dove area where large concentrations furnished some of the finest shooting in the State, no longer supports the large concentrations that it supported in earlier years. It is believed that the same factors described as reducing quail populations have greatly affected the dove range. Clean farming, winter plowing, winter cover crops, much increased grazing, and the great decrease in the use of legumes, grains and idle land as a rotational procedure have all cut deeply into the production of native and planted dove foods. This has apparently reduced or eliminated areas formerly used as large concentration areas. An excellent example of the effect of these changes may be observed just below Baton Rouge at the St. Gabriel Prison Farm. This farm still operates with mules and hand labor as power and it produces sugar cane and the rotational corn and legume crops by methods similar to those used in the past. It has now, and has had for the past twenty or thirty years, large concentrations of doves and excellent shooting. On the other hand, plantations on each side of the Prison Farm and all through the same general vicinity, now predominately in cattle production or producing cane by modern mechanized methods, have few doves.

Some doves still occur over the bottomland areas but they are more or less confined to the small, generally diversified farms. Such farms, no doubt, can and do support large dove populations, but usually the doves are not concentrated in great enough numbers at any one place to be hunted successfully.

Upper Mississippi-Tensas and Red River Alluvial Lands:

This area, like the Lower Mississippi, has seen greatly reduced dove concentrations in recent years. As in the southern section of the State clean farming and grazing have done away with much of the former dove range. In this area and particularly on the Macon Ridge, soybeans planted for harvest and the natural foods which grow in and associated with cotton fields still furnish good dove-concentrating areas. It is believed that if the national dove populations return to normal, this general area will still furnish good hunting.

NORTHWEST UPLANDS:

This large area of shortleaf and loblolly pine and hardwoods has a rather extensive farming section concentrated in the parishes of Caddo, Bossier, Bienville, Lincoln, Union, Claiborne, and Webster. These cotton and diversified farms along with large growths of doveweed (*Croton capitatus*) in most of the open areas furnish excellent dove feeding areas and huntable dove concentrations. Over much of the southern part of this area farms are too scattered to afford good dove shooting. Although northwest Louisiana has much good dove range, the southwest migration of locally reared birds before the hunting season and the arrival of the northern birds during quail season have resulted in a sporadic and relatively small amount of hunting in the area.

SOUTHWEST LOUISIANA PRAIRIE LANDS:

This area is an intensive rice-farming and cattle area. It is at present the primary dove range in the State and the only area in which a significant amount of dove hunting occurs. The reason for this is the general excellence of dove range in the harvested rice fields and in this area even on pastured lands. Cattle lands here produce good supplies of native dove foods because in effect they are fallow fields rather than permanent pasture. This condition is brought about as the cattle are grazed on idle rice-producing lands while it is rested after a year or two of rice production. This method of rotation is advantageous to the production of many types of weed and grass seeds that are utilized by doves.

The other ecological areas in the State do not contain enough range to be of any great consequence, yet certain specific but small areas where dove shooting is common should be noted.

One of these is a small, concentrated area of cotton and diversified farms across the northern part of the Florida Parishes. This section for years has furnished good but limited dove shooting and no doubt will continue to do so if the national dove population holds up. Increased grazing has been and will continue to be detrimental to the dove concentrations throughout this area.

Another area of some consequence as dove range is on the levees along the Red, Atchafalaya, and Mississippi Rivers. Much of these lands support good growths of ragweed, doveweed, and various grasses and weeds utilized by doves. It also affords good watering areas. The resulting combination has been good dove range and generally good shooting for many years. Here again we find increased grazing taking a toll. Much of this land is now leased, fenced, and heavily grazed. The result is much smaller dove concentrations and poorer hunting.

HUNTING PRESSURE, AND CONCLUSIONS

Hunting pressure in Louisiana at present is not believed to be significant. Areas in which doves were formerly subjected to heavy kills now have little or no hunting and those areas now containing reasonable dove concentrations are not heavily hunted. The one exception to this is in the southwest Louisiana rice and prairie sections. Here, dove hunting is fairly generalized and a questionnaire furnished hunters indicated that as high as 70 per cent of the hunters in this area hunt doves to some extent. This is considerably greater than the average for the State which is indicated to be less than 40 per cent by limited random sample.* The hunters in this southwest prairie section averaged 9.7 hunts per season with an average kill of 6.3 birds per hunt or 62 birds per season. In other less populated areas, hunters averaged 3.5 hunts, killing 5.4 birds per hunt for a season total of 19 birds. It is doubtful if these figures can be considered much more than a trend because of so small and biased a sample. It is interesting to note, however, that the amount of dove hunting is controlled by the number of birds actually in the area. Although hunters kill about the same number of birds per hunt in all areas they will not make a great number of hunts when birds are scarce. It is also interesting to note that even in areas of high concentration the average number of hunts is only about 10 per season. Apparently, these

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*These figures are taken from a relatively small sample of hunters associated with the Louisiana Wildlife Federation and probably only represents the trend in this certain class of hunters. The over-all percentage for all license holders is probably even less.

10 hunts are about all that the average man can squeeze in during a hunting season on any given game type and when seasons overlap the number of hunts must be divided among several types.

At the present time, no figures are available on the total State kill, but in the opinion of this investigator, it seems to be of little significance in controlling populations. This is an important question, however, and the answer should be determined as soon as possible.

In conclusion, it is evident that the present low dove population wintering in Louisiana coupled with a decline in the quality of the general dove range has reduced Louisiana's dove hunting to an extremely low point. It is believed that every reasonable effort in the way of cooperating with other states for research and study of dove conditions should be made in order to alleviate this condition if possible.

Since so little is known of the causes behind the change in dove conditions and since the hunting regulations are made by Federal Authority, no recommendations need be considered here.

Rabbits

There are two species of rabbits in Louisiana, one of which is represented by two races. According to Lowery (1943), the cottontail (*Sylvilagus floridanus alacer*) occurs over most of the State while the two races of swamp rabbits have separate and more limited ranges. One race (*Sylvilagus aquaticus aquaticus*) is found over most of Louisiana, but is confined to the wetter woodlands and bottomlands along streams. The other race (*Sylvilagus aquaticus littoralis*) is restricted to a narrow strip along the coast.

During this inventory, only a superficial study was done on rabbit conditions. The rabbit, one of the most hunted animals in the State, furnishes sport to many and food for many more; it was not examined closely on this inventory because it is one of the most difficult animals to determine specific facts about, and in Louisiana its general abundance precludes the necessity for making a basic management plan. It is a peculiar fact that the common rabbit so familiar to all has been studied less than most game species. The reasons seem to be its adaptability to varying habitats, high populations, rapid breeding rate, and unselective feeding habits make this animal difficult to study. The further fact that high rabbit populations are subject to various types of predation and cyclic attacks of disease makes a single inventory of little value. Frequent population checks would be necessary to determine rabbit conditions accurately. Nevertheless, it is evident that this major game species is in need of study, particularly in the southern States.

RECENT HISTORY OF RABBIT CONDITION IN LOUISIANA

Although the rabbit has always been reported to be abundant, it apparently became more abundant after the virgin forests were cut and when farming and second-growth thickets of protective cover became extensive. The peak population, as occurred with other species of farm game, was apparently reached some time after 1900.

The extremely high number of rabbits that did occur in Louisiana may be, in part, realized as we examine the amount of gun pressure these animals were subjected to over the years without any apparent decline in population until recently. Long seasons, no bag limits, market hunting and night hunting were all legal and widely practiced until recent years. Market hunting was made illegal and bag and season limits were placed on this animal only during the past 5 years.

Although it is probable that rabbits have been declining slowly since the late 1920's when farm practices began to change, the decrease was not markedly noticeable to the hunter until after 1940. Since that time, the rabbit population has presumably reached an all time low in the State. Whether or not this is a cyclic low that has occurred before or whether it is a permanent decrease is not known. Many new land use factors that have come about during the past 15 years, no doubt, have had some bearing on the decrease, but much study is needed to determine the exact effects of these factors.

GENERAL LIFE CYCLE AND ECOLOGY

Most of the studies on the life cycle and ecology of the cottontail have been done in the Midwest and East. The general facts may be applied to conditions in Louisiana.

Rabbits are known to breed every month of the year with the peak breeding season beginning in February and continuing through September. They produce three to four litters per year in the

Northern States and probably more than this in southern areas. The total number of young produced in a year per female is potentially 25 or more, but it is doubtful if more than an average of 15 to 18 actually are produced. Mortality among the young after birth is also high and the number reaching maturity probably does not exceed 20 per cent. Under normal conditions, however, this is enough to make the rabbit one of the most numerous of game animals.

The cottontail is not a great traveler, seldom moving in a radius greater than one mile and in many instances living most of the time on 15 or 20 acres. Details of the swamp rabbit range have not been worked out, but it would not be surprising if their range was greater in view of the fact that they run over a much greater area than the cottontail when chased by dogs.

Rabbits are vegetarians, but the wide variety of plant foods utilized by them makes food of little or no consequence in the management of this animal. Trippensee (1948) lists a total of 81 trees, 65 shrubs, and 55 herbs used by the cottontail. In the Southern States where the growing season is long, it is doubtful that food would ever become a limiting factor unless rabbits become so numerous as to constitute a nuisance.

Cover, on the other hand, is very important and may be a major limiting factor to rabbit populations on farms. The rabbit is one of the most vulnerable of all game animals to predation both from avian and mammalian predators. Because of this, they must have protective or escape cover in order to utilize the maximum benefits of the range. It is believed that a loss of cover occurring with changes in farm practices may have had much to do with the recent rabbit decline.

RANGE AND POPULATION

The rabbit is the one game animal that ranges over the entire State. From the chenieres and natural levees of the marsh to the ridges of the deepest swamps, rabbit signs are usually easily found. This would indicate that there is over 25,000,000 acres of occupied rabbit range in the State.

The general quality of most of the range in the State is considered good, but some areas do carry a much higher density than others. The biggest factor reducing range quality has been the increase in clean farming practices and in pasture lands during the past 15 years. The general practice of cleaning fence rows, plowing up weed fields, and cutting brushy thickets has removed the chief haven of the rabbit in the intensively farmed areas, primarily the bottomlands. The total amount of such range lost by these changes probably does not exceed 5 to 6 million acres over the State, but, unfortunately, it has occurred in areas where rabbit hunting is most popular as a sport.

The total rabbit population can only be guessed at. Dense populations may run as high as one to the acre and no doubt many such areas do occur in Louisiana. On the other hand, the average density probably may run as low as 1 in 5 or 10 acres. Former high populations would indicate that more likely the density is around 1 to 5 acres or greater with a total State population that exceeds 5,000,000, and which at times may approach 10,000,000.

LIMITING FACTORS

The primary factors limiting high rabbit population may be listed as follows: (1) predation, (2) disease, (3) weather extremes. These factors vary in their effect on rabbit population.

The annual kill in Louisiana is not known nor is it easily estimated. A survey of hunters' opinions would indicate that not as many hunters hunt rabbit as hunt squirrel, but, until recently, unlimited bags and market hunting may have over-balanced this factor. It is also true that many rabbits are taken by negroes and farmers for food, but it is surprising how small a nucleus of hunters hunt rabbits for sport. For example, the same series of questionnaires which indicated that 40 per cent to 50 per cent of the hunters hunted quail, dove, and waterfowl showed that only 14.7 per cent hunted rabbits during the same year. This, of course, is a biased sample of Wildlife Federation members but it does show that rabbit hunting is not considered a sport by a certain type of hunter. Along this same line, the field biologists reported that in many areas, but particularly in the hill parishes, the rabbit was hunted almost exclusively by negroes for food. On the other hand, in certain sections of the Mississippi-Atchafalaya Alluvial Plains, the hunting of swamp rabbits with beagles is much pursued and is a major sport. Rabbit hunting camps are common and it is not unusual for a hundred or more rabbits to be killed by a small group of men over a 2- or 3-day period.

Taking everything into consideration, it would seem that, although the annual kill of rabbits in the State is large, it is probably not large enough to be causing the decline in population. One thing seems fairly certain and that is that the population is on the decline in lightly hunted as well as in heavily hunted areas.

Predation may be a factor in the recent decline. The fox population is definitely on the increase and this is the most serious of the rabbit's enemies. This increase in foxes is particularly noticeable in the lower Mississippi flood plains where 30 years ago foxes were generally unheard of. The cause for the spread of foxes is not known. A few have been released by fox hunters, but it does not seem likely that they started a new limit of range by this method. It is possible that the great increase in fox hunting has run many foxes into new areas. Coupled with predation by foxes is the probable increase in predation by birds of prey, in particular the owls and hawks, as protective cover has become scarce on many farming areas. Since rabbits have lived with predators all through the years it is not likely that this is the major cause of the state-wide decline. The combined effect, however, of the recent increase in foxes and a lack of cover in the bottomland areas where rabbit hunting is most popular may be the cause for many hunter complaints about a noticeable scarcity of rabbits in this area.

Disease, either tularemia or other types, may be causing a cyclic low in the rabbit population. On the surface, this would best explain the general and rapid state-wide decline felt during the past few years. No evidence of any marked outbreak of such diseases has been discovered, however, either in rabbits or humans.

Extremes of weather in some instances may have an adverse effect on the rabbit population. Heavy rainstorms and hurricanes in summer months may kill off many young. Snow and ice in winter have been reported to kill adult rabbits in the northern States, but it would seem unlikely that the two or three snow and ice storms that have occurred in the State since 1945 could have greatly damaged the rabbit population. There were no reports or evidence of any effect on rabbits, but quail, doves, and songbirds obviously suffered during these cold spells.

CONCLUSIONS AND RECOMMENDATIONS

This inventory has only resulted in the determination that extremely high rabbit populations have apparently taken a sharp drop during the past 5 years. The cause of this drop is not clear nor is it known whether a stable point in the decline has been reached.

It is recommended that detailed studies be made of rabbit conditions in accordance with its general importance as a game animal and a source of food. Recent shortening of the season and bag limits have been more than ample to take care of excess kills in most areas of the State and may even prove to be much too low if the rabbit population should start an upward swing of its cycle.

Although the present rabbit population is low, it is still much higher than that of many other species of game and moderate kills may still be easily made. Insofar as can be determined, only those hunters used to unlimited bags are finding rabbits extremely scarce. Such extremely high kills are not necessary from the standpoint of hunting for sport and they may be a great contributing factor to low populations in specific areas.

WATERFOWL

The waterfowl picture in Louisiana is of such magnitude and complexity that it is the least clearly understood game problem in the State. Several agencies make a limited attempt to study this problem annually but their findings about ducks are so divergent and are backed up with so little reliable data that few people are willing to accept the results obtained. There are those who claim that several million waterfowl winter in the State and that the annual kill approaches a million, while others claim that a far smaller number visits the State with the kill in the region of 100,000 or so. Insofar as could be determined on this study, both of these points of view seem to be extremes with the true answer lying somewhere in between but possibly nearer the low population, low kill idea. The criticism of all studies thus far, including this one, is that not enough time, man power, and detail of procedure could be applied to the waterfowl problem to produce indisputable facts. Fortunately, before the completion of this study another project specifically directed at studying waterfowl conditions in north Louisiana was organized and put into operation. This new study was made by Mr. Richard Yancey, the project leader, who is responsible for the collection of much of the data used in this discussion. The findings of the north Louisiana waterfowl study proved to be of such significance that the project has been expanded to cover the entire State in order to complete a factual picture of waterfowl conditions throughout Louisiana.

The discussion of waterfowl as presented here includes a general study of the history of conditions in the State and the present conditions that could be determined by interviews and parish-by-parish observations. In addition to this, a preliminary analysis of specific present-day conditions based on band returns, flight records, and populations will be offered. Much of this latter approach is based on field data collected and submitted by Yancy (1949-50), and to him should go full credit for this information.

HISTORY OF THE WATERFOWL CONDITIONS IN LOUISIANA

It is generally agreed by many authorities that Louisiana is one of the most outstanding waterfowl wintering areas in North America, yet the average Louisiana hunter will quickly assert that his waterfowl hunting success is below par and he has sound reason for this belief. The truth of the matter is that, although Louisiana has vast water and marsh areas and is uniquely located at the foot of the Mississippi Flyway from which it receives much of its waterfowl population, the annual kill during recent years in the State has not been very large. The reasons for this are varied but many are reflected in the history of waterfowl conditions in the State.

The history of waterfowl conditions in the State falls logically into four general phases. These are discussed separately.

Phase I—This phase covers a period from before the coming of the white man until about 1830. It represents a period of rather stable and bountiful waterfowl conditions. According to duPratz (1758) and other early writers, myriads of waterfowl flocked into Louisiana during the winter months and large kills were easily made. During this time, Louisiana, with no man-made levee system to control waters in its swamps and lowlands and with the vast undisturbed coastal marsh, furnished a winter haven without peer for waterfowl. During this time, it is doubtful if any factor other than poor breeding years or disease affected fall waterfowl populations. Since the breeding areas were an undisturbed wilderness in northern United States and Canada, more than likely ample breeding occurred at all times and a fairly stable condition existed.

Phase II—This phase involved an 80-year period from 1830 to 1910 during which time the fabulous tales of waterfowl hunting, market kills, and large populations came into being. With the increase in white population and the increasing demand for waterfowl on the markets of the larger cities thousands of waterfowl were slaughtered. Just how great was the annual waterfowl kill during this era can only be surmised. Yet, as large as it was, it evidently took many years to reduce the annual populations. Apparently, by 1900 some conservation-minded individuals were looking for a way to check the slaughter and laws were enacted to control seasons and kills. It was during this phase that the national waterfowl population is reported to have started a decline to the all-time low reached in the 1930's.

Phase III—This phase, covering the period 1910-1932 was marked by a great decline in the national waterfowl population, apparently occasioned by a number of factors. One of these was that hunting pressure caused a greater kill and a faster decline in waterfowl must have been based on complaints of smaller kills by the hunters. Such complaints no doubt occured in Louisiana as well as over the nation, but the few records available in Louisiana indicate that the market kill was fairly stable until it was declared illegal around 1920. Furthermore, sportsmen interviews show that the sporting kill was generally good until 1930. This evidence tends to indicate that the decline in waterfowl was not marked in Louisiana until 1930. Since that time, much shorter seasons and reduced bag limits have entered the picture so that it is difficult to tell whether hunter complaints are caused by restrictions or an actual lack of waterfowl. Another and more clearly defined reason for the decline in the national waterfowl population was the loss of great areas of breeding grounds in the northern parts of the United States and Canada as the demand for wheat caused watered areas to be drained. Finally, the decrease in national population has been emphasized in Louisiana by many changes in the wintering grounds which probably have reduced considerably the number of ducks using this area and have certainly made killing them more difficult and expensive. The changes in Louisiana, reaching their peak about 1932, include the building of a vast levee and drainage system which resulted in the loss of thousands of acres of wintering range in the swampy areas away from the coast and the encroachment of the water hyacinth in the remaining areas which denied many bodies of water to waterfowl as this exotic crowded out food plants and blanketed vast open water areas.

With the noticeable decline in population and kills in the area various efforts were made to protect the wintering waterfowl population. In 1912, the season was limited to 115 days and the bag limit to 25. Market hunting was still allowed, however. By 1918, more stringent laws were enacted. The season was reduced to 90 days and market hunting was finally declared illegal. A bag limit of 25 and a 90-day season remained in effect until a further reduction in the national waterfowl population brought about Federal control in 1932-33. During this period, hunting conditions were fairly stable in Louisiana and all evidence points to fairly uniform annual kills until the late nineteen twenties and early thirties when the national population took another sharp drop.

Phase IV—This phase covers the period—1932 to 1950. It represents a time of various manipulations of seasons and bag limits by the Federal authorities in an attempt to stabilize the national waterfowl population.

During this period, waterfowl hunting conditions and the annual kill have deteriorated considerably within the State. The reasons back of this change are manifold and cannot be attributed solely to a decline in the national waterfowl population or to the increase in hunting pressure. Some of the factors affecting the success of waterfowl hunting during this period may be outlined as follows.

The primary factors controlling the annual waterfowl kill of the Louisiana hunter are not necessarily a decrease in the national waterfowl population but rather a decrease in the number of birds wintering in Louisiana, the 30- or 40-day season, the restrictions on shooting before sunrise or after sunset, a low bag limit, and increased restrictions on public shooting, particularly in the marsh areas.

There is little doubt that the increase in impoundments and refuge areas and the practice of flooding rice fields and pine-oak flats in the states just north of Louisiana hold hundreds of thousands of waterfowl and prevent their ever reaching the Louisiana wintering areas. These changes have become widespread and have produced good waterfowl hunting for those states since 1935 or 40; the only outlook is that these practices will increase rather than decrease. The number of waterfowl lost to Louisiana because of this trend is probably much greater than is realized by the average observer.

The 30-day season, no doubt designed to control kills, is doubly effective in Louisiana. Unless it is set for mid-November and early December practically all of the north Louisiana hunters lose their only reliable time to shoot waterfowl because of the peculiarity of flight patterns. (See Graph VII). Furthermore, since the seasons, long or short, have not recently extended into late January and February, much of the late winter shooting, the only kind available in some areas away from the coast, has been eliminated. The short season has, in effect, confined most of the successful waterfowl hunting to coastal areas which are highly restricted and quite expensive to hunt. The result is that the majority of the average hunters in the State are without a place or a time to hunt waterfowl.

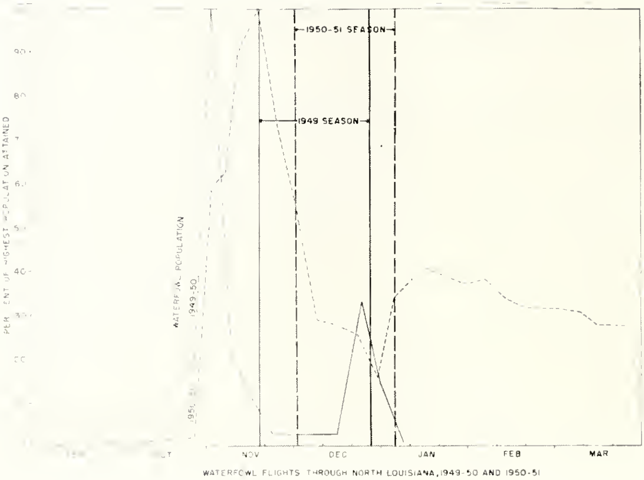


FIGURE 27, GRAPH VII

E. A. McIlhenny, one of the most active conservationists in Louisiana, pointed out as early as 1915 the harsh effect of limiting shooting hours for hunters in districts away from the coast. He states, "The time for shooting ducks should extend from one hour before sunrise to one hour after sunset. The reason for an hour before sunrise and after sunset is that in districts away from the coast and the high lands away from the feeding and roosting grounds, there is no shooting except during these hours. . . .if you do not let people in the districts where the ducks do not spend the day get an hour of shooting morning or night, they get no shooting at all and violate the law continuously because they will shoot in spite of the legal regulations and they are certainly entitled to this time for shooting." The above statements were made in a letter to the Conservation Commissioner serving at the time for presentation to the Legislature, which was then considering waterfowl laws. It seems evident from this that even in days of better populations large areas of Louisiana had waterfowl shooting restricted to short periods of time—both time of day and season during the year. Good hunting in the early days was no doubt in great part due to the unlimited right of the hunter to take waterfowl when and where he found them as much as to the larger populations of these fine birds. There is little doubt that restrictions on the time of taking waterfowl eliminates the use of large areas of Louisiana by the legal hunter, puts a premium on illegal hunting, and makes enforcement a difficult problem.

A bag limit of less than 10 has been effective in reducing kills in recent years in Louisiana. This, however, is reasonable and equitable since the protection of waterfowl is the purpose of such a law. Bellrose (1944) points out that even when bag limits were 25 or more during high populations, an average of 10 ducks per day was considered good under the best shooting conditions. This average was maintained in the better duck-hunting clubs until the bag limits dropped below 10 per day, but was probably not achieved by hunters without access to a club. The effect of the small bag limits in Louisiana has been to raise the cost of taking waterfowl beyond the means of the average hunter. In other words, many hunters who can only afford one or two trips to the coast each season do not feel it is profitable to make the trip for four ducks and, so, do not go at all.

The increased restrictions against hunting on private muskrat and oil lands, the fact that most of the State and Federal lands are refuges, and the general inaccessibility of Louisiana's marshlands make Louisiana's coastal wintering grounds far from a waterfowl hunting paradise for the average Louisiana hunter and artificially forces the annual kill well below what many might believe to be a normal kill for the State.

No doubt the restrictions cutting so heavily into the State Waterfowl harvest were designed originally to control excessive waterfowl kills, but, from the findings of this inventory and in the opinion of many familiar with waterfowl conditions in the State, there is much to show that Louisiana's annual waterfowl harvest is not equitable with other areas and is not nearly as high as indicated by Federal authorities.

Whether or not attempts should be made to correct this condition is beyond the scope or authority of this report. It should be noted, however, that the fate of the national waterfowl populations is more important than conditions in one State and unless changes can be made to help conditions in Louisiana without hurting other areas or the national population as a whole, there is little reason to expect such changes to be forthcoming.

WATERFOWL SPECIES WINTERING IN LOUISIANA

Lowery (1955) in a check list of birds of Louisiana lists 36 species of waterfowl. This group consists of 6 species of geese and 30 species of ducks. Table 66 lists the various types of ducks and geese recorded in the State.

TABLE 66

WATERFOWL SPECIES WINTERING IN LOUISIANA

DUCKS

MALLARD *(Anas platyrhynchos)*
BLACK DUCK *(A. rubripes)*
MOTTLED DUCK *(A. fulvigula)**
PINTAIL *(A. acuta)*
GADWALL *(A. strepera)*
GREEN-WINGED TEAL *(A. carolinensis)*
BLUE-WINGED TEAL *(A. discors)**
CINNAMON TEAL *(A. cyanoptera)*
EUROPEAN WIDGEON *(Mareca penelope)*
BALDPATE *(M. americana)*
SHOVELLER *(Spatula clypeata)*
WOOD DUCK *(Aix sponsa)**
REDHEAD *(Aythya americana)*
RING-NECKED DUCK *(A collaris)*
CANVASBACK *(A. valisineria)*
GREATER SCAUP DUCK *(A. marila)*
LESSER SCAUP DUCK *(A. affinis)*
AMERICAN GOLDENEYE *(Bucephala clangula)*
BUFFLEHEAD *(B. albeola)*
OLD-SQUAW *(Clangula hyemalis)*
HARLEQUIN DUCK *(Histrionicus histrionicus)*
WHITE-WINGED SCOTER *(Melanitta deglandi)*
SURF SCOTER *(M. perspicillata)*
COMMON SCOTER *(Oidemia nigra)*
RUDDY DUCK *(Oxyura jamaicensis)*
MASKED DUCK *(O. dominica)*
HOODED MERGANSER *(Lophodytes cucullatus)**
COMMON MERGANSER *(Mergus merganser)*
RED-BREASTED MERGANSER *(M. serrator)*
FULVOUS TREE DUCK *(Dendrocygna bicolor)**

GEESE

CANADA GOOSE *(Branta canadensis)*
HUTCHINS GOOSE *(B. minima)*
WHITE-FRONTED GOOSE *(Anser albifrons)*
SNOW GOOSE *(Chen hyperborea)*
BLUE GOOSE *(C. caerulescens)*
ROSS GOOSE *(C. rossii)*

* Known to breed in the State.

Certain of the species listed above are much more common than others, or at least are more easily killed since only a few species make up the greater part of the hunter's bag. Mallards, pintails, ring-necked ducks, green-winged teal, gadwalls, and wood ducks fill the hunter's bag in that order of importance. A census of waterfowl in north Louisiana made by Yancey (1950) indicates that mallards, pintails, green-winged teal, ring-necked ducks, canvasbacks, blue-winged teal, and gadwalls were the most common in the order listed. It is surprising how close the two lists compare in view of the fact that some ducks are more sought after and some are harder to kill. Geese are common only in certain sections of the coast and all types of geese in aggregate make up about 3 per cent of the total hunters' bags.

Of all the waterfowl listed in Table 66, only five are known to breed within the State. These are the mottled duck, wood duck, blue-winged teal, hooded merganser, and the fulvous tree duck. The resident population of none of these ducks except possibly the wood duck and mottled duck is great enough to affect significantly the wintering waterfowl population in the State. It is evident that Louisiana is dependent upon the fall migration of northern-nesting waterfowl for its huntable populations. It is also evident that the numbers and time of arrival of the various species as well as the bulk of the winter population in relation to the timing of the hunting season is an important factor.

WATERFOWL WINTERING RANGE IN LOUISIANA

Louisiana ranks fifth in the United States in water area having 1,982,080 acres of water. This probably represents only open water and does not take in the many potholes, sloughs, and swamps that occur in the State. In actuality, the total waterfowl range encompasses some 7,403,478 acres or about 23.8 per cent of the total State area. This range may be broken down as follows:

TABLE 67—WATERFOWL RANGE TYPES AND ACREAGE

TYPE	ACREAGE	REMARKS
Coastal marsh	3,929,298	Excellent range in fresh and brackish areas.
Cypress-tupelo swamp	1,092,100*	Second-growth thickets and water hyacinth ruin much of this area.
Lakes and rivers	1,982,080	Good only where food is available.
Rice lands	400,000	Excellent feeding when flooded; not all of area flooded.
TOTAL	7,403,478	

* The total swamp area is probably larger than this and during times of backwater, oak flats may be flooded which also adds to the quality and quantity of this type range.

The total acreage of waterfowl ranges is not distributed equally over Louisiana. For practical purposes, the State may be divided into three areas from a waterfowl range standpoint, both in respect to amount and quality. These are the north Louisiana area which consists of all or part of 27 parishes north of Alexandria, Louisiana, the south central Louisiana section consisting of all or parts of 17 parishes lying between Alexandria and the coastal areas, and 20 parishes in the coastal, rice, and lower Atchafalaya section. (See Figure 28). A description of the amount and quality of the range in each area is given below.

The Waterfowl Ranges in North Louisiana:

The extent of the waterfowl range in the 27 parishes north of Alexandria is dependent to a great extent on fluctuating water levels carried by the backwaters from the various rivers as well as on fall and winter rains. Such being the case, it is difficult to determine the exact total range, but an estimate would place it between 200,000 acres in dry years to as much as 1,000,000 acres during high waters. In either case, it is considerably less than in the coastal area and probably never exceeds 15 per cent of the total waterfowl range in the State.

The range in this area is variable, consisting of open water lakes, heavily wooded impoundments, backwater lakes, cypress brakes that flood periodically, some oak flats, and the Red, Ouachita, and Mississippi Rivers. There are some 100,000 to 150,000 acres in the larger, better-known lakes such as Bistineau, Caddo, Cross, Wallace, Black-Saline, Catahoula, Bruin, and Providence. Aside from such areas, there are numerous other small, little-known lakes and swamps, especially in the bottomlands of the Red and Ouachita–Tensas River systems.

The distribution of range in north Louisiana is such that the best areas and greatest waterfowl concentrations are highly localized in a few relatively small areas. According to band returns, 99 per cent of the waterfowl are taken in three general areas: (a) the bottomlands of the Red River as far south as Alexandria, and including Caddo, Cross, Wallace, Bistineau, and Black-Saline, and Clear Lakes, where 42 per cent of the north Louisiana waterfowl kill is made; (b) the Ouachita-Tensas system, including Catahoula Lake and various backwater swamps along this drainage system, where 49 per cent of the waterfowl are taken; and (c) the cut off lakes and

PLATE 22

Natural and artificial impoundments such as these furnish most of the waterfowl shooting areas in the upland areas of the State.

barrow pits along the Mississippi river where 8 per cent of the kill is made. Although these figures represent the average kill over a 3-year period in the area, they are also indicative of the primary range in the area. (See map, Figure 28.) The low kill figure for the Mississippi River area probably does not represent a true picture of the amount of waterfowl using this area, but rather only that it is a more difficult region to hunt. A further study of the band returns indicated that more than 55 per cent of the waterfowl in north Louisiana were either concentrated in five small areas with a total area of approximately 100,000 acres or else the easy accessibility of these areas makes them popular for hunting. The areas involved here are (1) the Caddo Parish area with Caddo, Cross, and Wallace Lakes; (2) Lake Bistineau; (3) Black-Saline and Clear Lakes; (4) Catahoula Lake; and (5) the vicinity of Ouachita Parish. (See map, Figure 27.) Studies by Yancey (1949-50) clearly indicate that three of these are primary waterfowl concentration points, and no doubt the other two will prove to be the same. It should be noted, however, that each area is within easy accessibility of one or more of four of the largest cities in north Louisiana. This might account for the greater kills and popularity of these ranges, but, on the other hand, no point in north Louisiana is too far from its large cities and the bulk of the duck hunters usually find their way to the best areas.

The quality of the ranges in north Louisiana is highly varied and many types of plants and animals occur in all lakes. Yancey (1949-50) by means of a stomach analysis of both diving and puddle ducks has compiled a preliminary list of foods. Table 68 is prepared from his findings.

It will be seen from the foods listed in the above table that the north Louisiana ranges contain a wide variety of excellent waterfowl foods. From a quantative standpoint, however, these ranges leave much to be desired. In practically all instances, the volume of food available is dependent upon high waters in the fall and winter. The minimum flood pool in most impoundments is too deep and stable except to produce a bare minimum of food plants in shallow areas and along the shores. Many of the foods eaten by ducks in this area are moist soil and higher land types. These do not become available to waterfowl until such high areas are flooded in the fall. Since this is the case, a bad growing season for such plants or a lack of water when migrations occur will result in few ducks

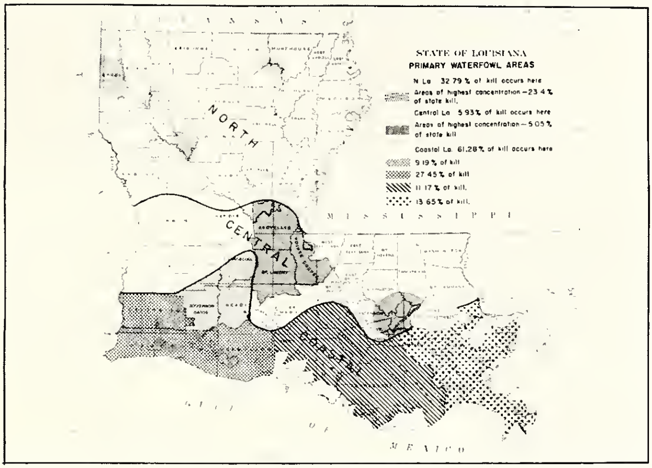

STATE OF LOUISIANA
PRIMARY WATERFOWL AREAS
N La 32 79 % of kill occurs here
Areas of highest concentration—23 4 % of state kill.
Central La 5 93 % of kill occurs here
Areas of highest concentration—5 05 % of state kill
Coastal La 61.28 % of kill occurs here
9 19 % of kill
27 45 % of kill
11 17 % of kill.
13 65 % of kill.
NORTH
CENTRAL
COASTAL
MISSISSIPPI
GULF OF MEXICO

FIGURE 28

stopping in the area. The necessity for a large volume of food can best be illustrated by comparing Lakes Catahoula and Bistineau. Catahoula Lake is an old lake normally receiving the flowage of Little River during low water conditions. At such time the actual flood pool is little more than a narrow stream meandering through the lake bed. The lake bed proper, consisting of some 20,000 acres, is dry at such times and is an ideal moist soil area for the growth of duck foods. The largest natural chufa bed (*Cyperus esculentus*) in the United States occurs in this dry lake floor. When rising waters in the Red and Mississippi Rivers occur in the fall, backwaters flood this large chufa bed and some of the finest waterfowl range in the United States is formed. With such a large volume of excellent food and a small refuge, Catahoula Lake is able to hold and maintain a good duck concentration in the face of some of the heaviest shooting in the State. The value of Catahoula for waterfowl is solely dependent upon water fluctuations which have created a condition unsurpassed for the growth of waterfowl foods. In recent years, some interests have advocated the damming of this lake and the maintenance of a minimum flood pool with an eight foot depth in the interest of bettering sport and commercial fishing. The maintenance

TABLE 68

WATERFOWL FOODS DETERMINED BY STOMACH ANALYSIS OF DUCKS KILLED IN NORTH LOUISIANA*

Plant foods		Utilization by ducks	
Common name	Scientific name	Puddle ducks	Diving ducks
Beard grass	(*Andropogon* sp.)	X	
Bur marigold	(*Bidens* sp.)	X	
Buttonbush	(*Cephalanthus occidentalis*)	X	X
Buttonweed	(*Diodia virginiana*)	X	X
Chufa	(*Cyperus esculentus*)	X	
Coontail	(*Ceratophyllum demersum*)	X	
Cyperus	(*Cyperus farax*)	X	
Cypress	(*Taxodium distichum*)	X	X
Duckweeds	(*Lemna minor & woeffiella*)	X	
Hackberry	(*Celtis laevigata*)		X
Myrtle	(*Myrica* sp.)	X	X
Poison Ivy	(*Rhus radicans*)	X	X
Pondweed	(*Potamogeton americanus*)	X	X
Pondweed	(*P. pectinatus*)	X	
Pondweed	(*P. pusillus*)	X	
Primrose willow	(*Jussiaea decurrens*)		
Ragweed	(*Ambrosia trifida*)	X	
Rush	(*Eleocharis* sp.)		
Saw grass	(*Cladium jamaicense*)	X	X
Sedge	(*Carex* sp.)		X
Smartweed	(*Polygonum* sp.)	X	
Spikerush	(*Eleocharis quadrangulata*)	X	
Supplejack	(*Berchemia scandens*)	X	
Teal grass	(*Eragrostis* sp.)	X	
Turnsole	(*Heliotropium indicum*)		
Walter's Millet	(*Echinochloa walteri*)	X	
Water shield	(*Brasenia schreberi*)	X	
Wild Millet	(*Echinochloa crusgalli*)	X	
Yonkapin	(*Nelumbo lutea*)		X
Animal foods			
Clams	(*Pelecypoda*)	X	X
Crayfish, etc.	(*Crustacea*)	X	X
Insects	(*Insecta*)	X	X
Snails	(*Gastropoda*)	X	X

* Data collected by Yancey (1950-51)

of a non-fluctuating minimum pool permanently covering the present chufa beds would destroy this area as a waterfowl range.

For comparison with Catahoula Lake, Lake Bistineau is a good example of maintaining a non-fluctuating permanent pool. This lake, formed by damming an old, poorly drained flat, has a water level that has been held constant and which nearly fills out all of the area between hills. Very little fluctuation occurs and when it does, only relatively few acres along the edge become submerged. This results in a small amount of duck foods becoming available. Plans have been put into effect to elevate the present dam and water level by some 6 feet. Even with this much vertical increase, only 2,300 acres more will be flooded as compared to 21,000 that go under water when Catahoula Lake floods. It is obvious that, from a waterfowl standpoint, the water levels impounded by dams on many of the lakes in north Louisiana are held much too stable and too high. This prevents the periodic flooding of sizeable acres of shore line and decreases the amount of duck food produced. The result is that ducks use these areas primarily as resting places during the short period of migration and are easily driven away by gun pressure. In many instances, they leave the ranges of this section before hunting season opens, yet they remain for the entire winter in the rice fields and pinoak flats a hundred miles north of these in Arkansas.

In final analysis, the waterfowl range in north Louisiana must be considered to be of limited size, lacking in large quantities of food, and dependent to a great extent on natural water fluctuations. Many of the larger, more popular impoundments suffer from a food shortage because the dams were so constructed as to prevent extreme water fluctuations.

WATERFOWL RANGE IN SOUTH CENTRAL LOUISIANA:

This area, consisting of all or parts of 17 parishes, lies in a belt across the south central part of the State. (See map, Figure 28.) It includes all o fthe Southwest Terrace or pinelands, the Southeast Terrace Lands or Florida Parishes and several bottomland parishes along the Mississippi-Atchafalaya Rivers.

This area contains the least productive and probably the smallest waterfowl range in the State. Band returns indicate that only about 6 per cent of the total State kill occurs in this area and presumably the number of waterfowl using the area is correspondingly low. This is not surprising since the pine hill parishes are, for all practical purposes, devoid of water and the few ducks killed in them are taken in sloughs, millponds, and farm ponds. Some minor amount of jump-shooting may be had on the various small streams. There are, in fact, only two waterfowl concentrating points in this entire section. The swampy areas of St. Landry, Point Coupee, and Avoyelles Parishes along the Atchafalaya and Red Rivers form some rather good range where water hyacinths have not blanketed the open ponds. The backwater reservoir area in northern Avoyelles Parish with its many channel scar lakes and annual flooding is a particularly good area. Here alone are killed nearly 50 per cent of all the waterfowl taken from this general area. The only other area used by waterfowl to any extent is the Lake Maurepas-Blind River Swamp area consisting of parts of Ascension, Livingston, St. James, St. John, and Tangipahoa Parishes. This area is a typical cut-over cypress-tupelo swamp of some 200,000 to 300,000 acres. Shortly after cutting, when many ponds were open and before the water hyacinth, buttonbush, and second-growth thickets took over much of the area, this was an excellent waterfowl range annually used by thousands of ducks. At the present time, open water is at a premium in much of the area and the numbers of waterfowl visiting it are much reduced from former years.

It is in this south central region and in the heavily wooded swampy areas of north Louisiana that legal dawn and twilight shooting are necessary if successful hunting is to be had. The ducks scatter widely over expanses of flooded woodlands. This prevents shooting over decoys or feeding areas to any extent. It is only during the flights of the birds to and from roosting and feeding that hunting may be successful.

At the present time, except in the Avoyelles Parish area, this section is not very suitable for waterfowl and, unless the water hyacinths are removed and waterfowl development projects started, little hope can be held for the future of the area as a waterfowl hunting site.

The Waterfowl Ranges in the Coastal Marsh, Rice Areas, and Bordering Swamps:

A detailed study of waterfowl conditions in the vast coastal marsh and its adjoining areas has not been accomplished on this project because it would have required time and equipment beyond the scope of this inventory. Such a study has now been put into operation in the form of a separate project that is expected to continue for three or more years. The discussion as presented here is based on records and information available from past years, an analysis of band returns, the ecological findings of

O'Neil (1949), and general observations and interviews over the area.

The coastal marsh of Louisiana, its bordering swamps, and the rice area of southwest Louisiana probably constitute the largest general waterfowl wintering area in the United States. Its total area probably exceeds 5,500,000 acres, but all of this is not suitable for waterfowl. Most of the waterfowl food plants are confined to the fresh and brackish-water marshes and to the fresh water ponds throughout the area. Apparently, large sections of the more saline marshes are not used by water fowl to any extent for feeding areas. Food and water conditions are highly variable throughout the marsh and the waterfowl concentrations move from one area to another as the need arises. Contrary to the belief held by many not familiar with the coastal marsh, waterfowl do not blanket the area as a whole and there are vast sections of marsh that one may visit in mid-winter without seeing more than a few ducks. On the other hand, the tendency of a major portion of the entire coastal waterfowl population to concentrate in small areas where food is extremely plentiful has resulted in stories and photographs implying that fabulous numbers of waterfowl occur in the area. This results in many misconceptions about waterfowl conditions on the coast.

The general quality of the waterfowl range throughout this area must be considered good, though highly variable. In the coastal area, high salt water tides, hurricanes, droughts, excessive rainfall and fresh waters from various rivers all affect variety and quantity of the duck foods available. If climatic extremes tend to dry out an area, increase its salinity, or flood large areas with briney tides, the result is usually a temporary loss of food. The vegetation, killed by such conditions, may be replaced by salt to brackish water species if the area remains saline. If, however, rainfall is sufficient, certain fresh water annuals such as wild millet and smartweed may completely dominate the area. When this happens, the temporary mass increase in duck foods creates an unusually excellent waterfowl food supply and attracts thousands of birds. According to O'Neil (1949), this occurred in 1926-27 and resulted in waterfowl concentrations greater than had been seen since 1900. Thus, the more fresh water in the marsh the better the waterfowl food conditions. This is borne out by the fact that the fresher areas around the Mississippi Delta and the larger fresh and slightly brackish areas maintained behind the chenieres in west Louisiana provide the most used waterfowl areas on the coast.

According to O'Neil (1948), changes have occurred in the Vermilion-Marsh Island area since 1920 that have greatly depleted the waterfowl foods. Major muskrat "eat-outs" have polluted fresh water ponds to the extent that submerged plants have been greatly reduced. Excessive salinities prior to 1940 prevented the return of many of the fresh water duck foods. Other changes have occurred, but it has not yet been determined whether they are beneficial or detrimental. These include the silting of Vermilion Bay with fine river sands from the Mississippi and Atchafalaya spillway and silting from the Mermentau River brought on by effects of the Intra-coastal Canal. This has resulted in a great increase in fresh water in the general area that might aid in producing waterfowl foods if silting does not inhibit their growth.

A study of waterfowl band returns indicates that some 61 per cent of the waterfowl are killed in the coastal area. This is not indicative of the proportion of the State's waterfowl population using the coastal area since presumably 90 per cent of all of the ducks and geese entering the State eventually spend some time in the marsh area. It is more than likely that the restrictions on hunting or the general difficulties of hunting in the area keep the kill low in comparison with the rest of the State. Band returns do indicate that the best marsh areas for hunting success are in Cameron, Calcasieu, and Vermilion Parishes, the next best is that area surrounding the city of New Orleans, followed by the rice-producing parishes and finally the least productive is the lower Atchafalaya-Lafourche area—whether or not the quality of the range and the waterfowl populations using them vary in the same order was not determined. Greater hunting pressure in the vicinity of Lake Charles and New Orleans as well as less restrictions on land might account for higher kills. If this is true, then the central part of the marsh is acting as a large refuge with a very low hunting pressure.

In summation, it must be made clear that much investigation needs to be done in the marsh area before the exact waterfowl picture may be had. It is hoped that the present waterfowl project will supply this information.

WATERFOWL FLIGHTS, DISTRIBUTION, AND POPULATION

The first fall flights of waterfowl start entering Louisiana with the early arrival of blue winged teal in August and September and usually reach a peak by mid-October. Lowery (1955) has published the most recent sight records of the first fall appearance of all waterfowl species. According to his list mallards, pintails, baldpates, and shovellers start arriving as early as September. Sight records have not yet been obtained earlier than October for the black duck, red-head, ring-necked duck, and ruddy duck, or before November for the canvasback, greater scaup, buffle-head, old squaw, and scoter. Most of the geese start arriving by October.

Yancey (1949-50) in a rather complete 2-year study of certain key north Louisiana waterfowl areas has, by taking a weekly census, been able to determine the time of arrival of the flights. Table 69 is a tabulation of his combined population studies. Graph VII is the same information in graph form for the 2-year period. The per cent of peak population was used rather than the actual figures so that the two years could be readily compared. The 100 per cent peak reached in each case represents the point at which the maximum population was attained in North Louisiana during the fall and winter. All other points are relative to this maximum. The information gained in this manner probably represents the arrival of the bulk of the ducks in Louisiana and certainly is a true chronological picture in north Louisiana. Some ducks apparently do arrive on the coast without passing through north Louisiana. This is evidenced by the fact that large pintail populations are known to occur in the southwest marshes before they appear in north Louisiana. This would definitely indicate that Louisiana receives some of its waterfowl from the central as well as the Mississippi flyway.

The findings of Yancey's 2-year study of waterfowl in north Louisiana confirms what has long been known by hunters and other careful observers, i. e., the bulk of the flight passes through north Louisiana early in November and this is the month in which the most successful hunting can be expected during the fall or early winter. Graph VII also indicates that ducks move back into the uplands to a certain extent in January and February. The occurrence of such late winter flights during spells of adverse weather and as they begin their northward flight furnished much of the waterfowl

TABLE 69-a

WATERFOWL POP. ON CERTAIN KEY AREAS IN NORTH LOUISIANA* 1950-51

Date	Mallard	Pintail	Shoveller	Baldpate	Gadwall	Black Duck	B.W.Teal	G.W.Teal	Wood Duck	Canvasback	Scaup	Ringneck	Ruddy	Geese	Total
Sept. 26							35		1,200						1,235
Oct. 2		161					120	20	1,525						1,826
Oct. 9		268	25		10		91	62	1,532						1,988
Oct. 18		310					203	76	999					560	2,148
Oct. 26		325	50	75	34		234	166	583	40	100	200	50	417	2,274
Nov. 2	845	12,155	1,110	13,910	10,310	50	15,350	17,685	706	600	5,675	9,855	800	1,013	90,064
Nov. 7	5,175	35,930	1,210	4,000	10,750	300	1,985	20,675	1,020	600	3,375	9,070	500	1,268	95,858
Nov. 11	50,050	31,925	1,690	960	10,300	1,100	415	29,150	1,160	500	1,650	6,500	150	1,525	137,075
Nov. 18	51,275	38,850	2,675	1,075	9,650	1,300	155	38,775	1,050	450	975	5,550	100	860	152,740
Nov. 25	45,655	10,690	3,252	935	6,525	1,100	75	35,665	1,200	400	940	4,300	100	420	111,257
Dec. 1	40,012	5,175	2,558	250	710	1,000	50	30,300	425	400	528	2,900	200	400	84,908
Dec. 8	21,300	3,100	835	290	608	500	......	12,387	850	275	775	3,000	250	......	44,170
Dec. 15	19,300	2,175	930	324	1,250	500	......	13,560	925	400	875	1,865	400	......	42,504
Dec. 22	16,350	3,120	630	256	1,475	200	......	12,560	1,000	500	1,025	1,450	300	......	38,866
Dec. 29	8,650	3,140	245	100	1,485	100	......	8,550	1,175	200	645	1,325	100	......	25,715
Jan. 5	2,795	1,220	45	101	630	......	......	525	685	21,000	180	24,540	225	......	51,946
Jan. 15	2,950	1,935	52	225	855	......	......	185	815	24,000	75	30,640	250	......	61,982
Jan. 22	2,895	2,200	65	617	1,255	......	......	50	425	23,000	95	28,605	200	......	59,407
Jan. 29	3,785	1,900	70	560	1,360	......	......	90	345	23,000	135	25,085	120	......	56,450
Feb. 6	3,675	2,700	125	700	1,335	......	......	150	147	24,000	50	25,175	75	......	58,132
Feb. 13	2,065	650	25	591	1,290	......	......	90	135	22,500	75	23,885	150	......	51,456
Feb. 20	1,165	125	......	725	1,055	......	13	35	109	23,000	80	21,480	125	......	47,912
Mar. 1	700	145	35	565	1,360	......	40	......	90	22,000	125	22,190	100	100	47,450
Mar. 9	575	25	......	430	1,005	......	45	20	35	23,000	175	20,650	175	700	46,835
Mar. 15	445	55	......	225	955	......	60	......	38	21,000	150	20,585	250	140	43,903
Mar. 22	195	20	......	250	400	......	89	......	35	21,000	140	19,625	450	......	42,204
Mar. 26	130	......	......	125	395	......	48	......	......	20,500	300	19,540	500	......	41,538

* Combined figures from Yancey's studies on Marengo Bend, Catahoula, Black-Saline, and Lake Bistineau.

TABLE 69-b

MARKET & AMATEUR WATERFOWL KILL[*] FOR FIVE YEAR PERIOD 1913-18

SPECIES	1913-14	1914-15	1915-16[**]	1916-17	1917-18[***]
Mallard	117,843	99,613	92,252	126,552	105,708
Pintail	27,955	17,963	71,486[**]	22,140	7,466
Ringneck	13,532	8,260	26,544	7,903	1,798
Gadwall	15,620	6,419	20,652	22,688	2,540
Canvasback	1,037	1,522	5,448	2,723	1,646
Redhead	798	496	516		1,006
Spoonbill	36,864	14,471	22,908	19,851	12,156
Teal	30,276	21,378	16,159	33,891	4,210
Scaup	38,560	6,432	13,067	13,524	2,138
Wood Duck	850		402		
Coots	39,114	28,260	14,636	36,108	17,824
Geese	2,315	1,652	494	3,233	1,762
Snipe	46,790	73,031	11,913	39,267	12,348
Total	371,654	279,498	296,563	330,345	185,614

[*] Market and amateur kill based on actual count of market receipts plus an amateur estimate, from the report of the ornithologists, report of conservation commission.

[**] "The season of 1915-16 developed several surprises as to the numbers of the different species that visited the States for the winter months. There was an abnormal influx of pintail ducks and a corresponding scarcity of mallards. This was probably due to the mild winter experienced and the fact that the gulf storms of August and September destroyed a great deal of food in two sections of the State: mouth of river, and in Cameron. Ducks concentrated in central portion of marsh.

[***] Dry years—flight big—ducks in deep water, no great kill by market hunters.

hunting prior to 1933, and now results in much of the illegal hunting that occurs in the State.

It is interesting to note that this flight pattern has been stable over many years. Graph VIII showing the market hunting kill in 1913-14 indicates that the bulk of the ducks were in the marsh by November when the highest kill occurred. February kills were extremely low indicating that many of the waterfowl had started to move out of the marsh by then.

The pattern of the waterfowl flights into and about the State needs considerably more study. A composite summation of Yancey's census figures for several key areas indicates that the bulk of the waterfowl population arrives in a rapid series of flights or in one big flight until the peak is reached; then it rapidly falls off. There is no clear evidence of general periodic flights spaced far enough apart to form several peaks in the population curve for all of north Louisiana, but some lakes may be devoid of ducks for a short time until a new flight arrives.

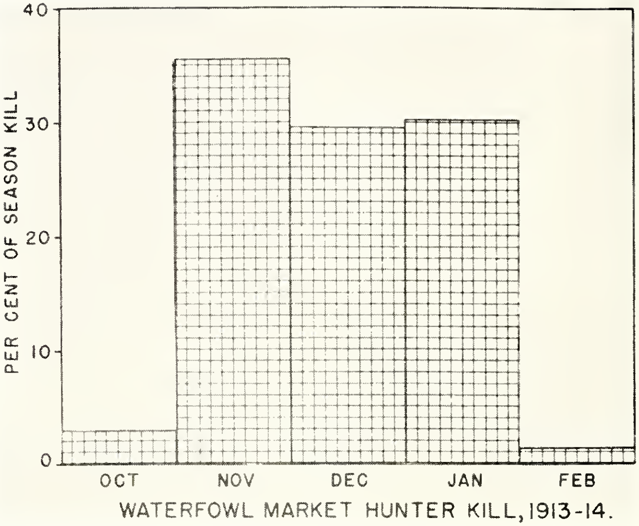


FIGURE 29, GRAPH VIII

It is not clear what portion of the State's waterfowl population goes directly to the coast or whether the peak reached in north Louisiana is indicative of the total number of birds that pass through the area. For example, the peak population reached on Catahoula Lake in 1950 was approximately 140,000 on November 18. It is not known just what part of the population using or passing through this area is represented by this figure. Some 28,000 blue-winged teal and baldpate had already entered the area and left by November 18, but the findings for the other species listed in Table 69 indicate that after the eighteenth of November there were few new arrivals and the population dwindled as more and more birds moved to the coast. The increase in ring-necked ducks and canvas-backs in January and February no doubt represents a movement up from the coast.

Local movements of waterfowl along the coast are apparently quite common. At no time may ducks be found over the entire marsh; instead, they move in larger concentrations to the various feeding areas in the marsh. The success of many a marsh hunter is dependent on his ability to locate the waterfowl concentrations in the coastal marsh.

The distribution of waterfowl population and the total waterfowl population in the State was not completely determined. Certain estimates and trends may be arrived at by a study of Yancey's finding in conjunction with band returns. Yancey's work was carried out on lakes consisting of some 54,000 acres in total area. At peak population, the average waterfowl density was three birds to the acre. Band returns indicate that two other areas, one in the Cross-Caddo-Wallace Lake section of Caddo Parish and the other in Ouachita, Morehouse, and Union Parishes within a 50 mile radius of the city of Monroe, produce kills equivalent to the areas studied by Yancey and presumably had similar populations at the same time. (See Map Figure 28.) The entire water area in lakes similar to these in north Louisiana is approximately 100,000 acres. This being the case, some 250,000 to 300,000 waterfowl probably were in the lake areas of north Louisiana at the peak on November 18. To this should be added an estimated 70,000 on the Mississippi River and a small scattered population in the smaller sloughs and swamps. By this method of estimating, a peak population of 350,000 to 400,000 is arrived at for north Louisiana on November 18. By hunting season on December 2, this population had dropped to less than 200,000 and by the end of the first week of the season to some 125,000, if the flight pattern shown in Graph VII is true for the entire area.

Another method of arriving at a total estimate for the area is to take a ratio between the band returns, the average population during hunting season on the known areas, and the total band returns for north Louisiana—Band returns on known areas: Average season population on known areas: Total bands: Total population—Calculations by this method indicates that an average of 120,000 waterfowl were in the area during open season. This checks fairly close to the 125,000 figure arrived at by a density per acre estimate.

If these estimates can be considered to have some degree of accuracy, it is evident that the population peak reached in north Louisiana, well before the hunting season, is nearly twice as great as on opening day and four times as great as the average open season population. This condition is based on a season opening around December 1. A season opening November 15 would place a greater portion of the waterfowl population in the area during the season, and one opening the first week of November would place the peak of the flights entering the State about mid-season. (See Graph VII)

The total number of waterfowl wintering in the State is dependent upon the national population, weather conditions, and various other factors. The only census work that has been done in the State as a whole is the United States Fish and Wildlife Service studies made each spring to determine the surviving populations. This survey, carried out with the use of aircraft and ground checks, is probably limited in its accuracy only by the small number of personnel involved. Their findings indicate a surviving population of approximately 1,500,000 waterfowl in 1950. This figure is reasonable in view of the fact that at least 500,000 ducks are known to have stopped for a short period in north Louisiana before proceeding to the coast. Certainly many more passed up the area since the quality and quantity of the range in north Louisiana before the winter high waters occur is limited. It is quite evident that the figures arrived at here are only estimates, but it is hoped that the present state-wide waterfowl study will finally answer these questions.

LOUISIANA'S WATERFOWL KILL, HUNTING CONDITION, AND SEASON

The questions of the Louisiana waterfowl kill, the hunting conditions in the State, the setting of seasons, and various other Federal restrictions are the most controversial wildlife problems in the State. Much bitterness on the part of the public has resulted from the timing of seasons and the restrictions advocated by Federal authorities in their effort to protect waterfowl. Unfortunately, the data used by Federal authorities to make such decisions does not necessarily agree with information gathered by State authorities or the observations of the lay hunters. With all groups concerned too few data have been collected and valid answers have never been reached. It is the primary aim of the present state-wide waterfowl study to gather enough data to achieve a much more accurate picture than has been presented heretofore. The discussion as offered here gives a kill analysis based on several methods but primarily on band return data and bag check figures compiled by Yancey for north Louisiana.

RESULTS OF INTERVIEW QUESTIONNAIRE METHODS:

In the original inventory project, the kill analysis was undertaken on an interview and questionnaire basis similar to the way it is handled by Federal authorities. Our findings, on the surface, were essentially the same as theirs, i.e., 30 to 40 per cent of the hunters claimed to hunt waterfowl and most of them indicated a significant kill. Average daily bag checks multiplied by the average number of hunts, times the number of duck stamps sold indicated a kill of the magnitude of 1,000,000 waterfowl. In working from parish to parish, however, and in general interviews with sportsmen it soon became apparent that this gave a distorted picture of the kill; it represented a biased sample since it was taken only around the good waterfowl areas.

Table 70 lists the kill per hunt, season kill, and various other information from as many sources as are avaialble for each area. Several interesting factors become apparent as the data in Table 70 are analyzed. Brown's data for hunting clubs on the coast indicate that the daily bag per gun closely approaches the legal limit and drops from a maximum of 10.17 birds per hunt when the limit was 15 to 3.78 when it was lowered to 4 per day. An analysis of the total club kill, however, indicates that 8 to 10 hunts are about all that one individual can manage in one season. A biased sample of sportsmen league members taken on this inventory from a club on the edge of the southwest Louisiana marshes indicated an average daily kill of 4.2 per day, 8.5 hunts per season, and a season kill of 36. A sample taken at the same time away from the coast in bottomland areas indicates a daily kill of 2.3, 5.3 hunts per season, and an average season total of 12.3 birds. The important factor in the last two cases is the difference in the number of hunts per season and the daily kill per man. It seems quite evident that no matter how diligent a hunter a working business man is, he can hardly average 8 to 10 hunts a season, even where ducks are plentiful, easy to hunt, and the inducement strong. In areas where waterfowl are more scarce and harder to hunt, the daily bag drops and the number of hunts drops even more rapidly. In a rather careful check of some hunters, Yancey found that nearly 90 per cent of the hunters hunted only on the first two days of the season leaving only about 10 per cent of the more skilled, veteran hunters to hunt the remainder of the season. It would seem that one of the biggest sources of error in calculating waterfowl kills is the use of an average season kill

TABLE 70

WATERFOWL KILL DATA

Season	Bag Limits	Area Where Data Collected	Kill/Hunt	Hunt/Season	Kill/Season	Source of Data
1942-43	10	Coastal gun clubs	8.27	8 to 10*	75*	Brown (1948)
1944-45	15	Coastal gun clubs	10.17	8 to 10*	90*	Brown (1948)
1946-47	7	Coastal gun clubs	5.02	8 to 10*	45*	Brown (1948)
1947-48	4	Coastal gun clubs	3.78	4 to 6*	20*	Brown (1948)
1942-43	10	Random survey			40.93	U.S. Fish & Wildlife
1950-51	4	Random survey	3.0*			U.S. Fish & Wildlife
1946-47	7	Sportsmen's club Sulphur, Louisiana	4.2	8.5	36.0	This inventory
1946-47	7	Sportsmen's club Tensas Parish	2.3	5.3	12.3	This inventory
1949-50	4	Bag check[1] study areas	1.1			Yancey (1950-51)
1950-51	4	Bag check[2] study areas	2.66			Yancey (1950-51)
1950-51	4	Bag check[3] study areas	1.80			Yancey (1950-51)
1950-51	4	Bag check[4] study areas	1.90			Yancey (1950-51)

* Estimated from total hunts for 30 clubs as published by Brown.

[1] Composite of bag checks on Marengo Bend, Black-Saline, & Catahoula Lakes.

[2] Bag check on Catahoula Lake.

[3] Bag check on Black-Saline Lake.

[4] Bag check on Lake Bistineau.

from a sample taken near good waterfowl areas or from better hunters and attributing such a kill to all or a substantial part of the duck stamp holders. In random interviews, a very large portion of the duck stamp holders were found to have never hunted or to have made one or two unsuccessful trips after which they gave it up for the remainder of the season. It is evident from Table 70 that the kill figures used by Federal workers as an average, and attributed to random sampling, are comparable to the kill figures taken by other biologists from a decidedly biased group in areas of definite duck concentrations. To apply such an average to all or a substantial part of the total duck stamp holders results in a kill figure that is apparently excessive. There is ample evidence that the majority of waterfowl killed in Louisiana come from a few choice hunting areas and except for the first day or two of the season, the majority of the kill is made by hunting club members, the few hunters fortunate enough to live near waterfowl areas, and a small per cent of other hunters who are experienced in hunting ducks. Thus, the total waterfowl kill for the State is not as large as generally indicated by Federal authorities. A more conservative estimate based on Yancey's bag checks, and taking into consideration the fact that many duck stamp holders make only one or two hunts, would place the 1950 kill for the State below 300,000 rather than as high as 900,000 as estimated by U. S. Fish and Wildlife workers.

The Band Return Analysis of Kill Distribution and Annual Kill:

The analysis of waterfowl band returns for the three years 1948-49-50 shows some rather interesting trends. It is doubtful if the 674 band returns from ducks killed in Louisiana is a large enough sample to be completely reliable but the pattern set by the analysis is clear and alleviates any question of biased data since it is a pure random sampling of where and how many waterfowl are killed.

A 3-year average of the total band returns indicate that 32.79 per cent of them were returned from 27 parishes in north Louisiana, 5.93 per cent from 17 parishes in south central Louisiana and 61.28 per cent in 20 parishes comprising the coastal marsh, rice lands, and lower Atchafalaya swamps. (See map, Fig. 28.) A further breakdown of the band returns indicates that a relatively few areas within each section of the State furnish most of the waterfowl hunting and State kill. These areas are listed on Table 71 and on the waterfowl map (Figure 28).

TABLE 71

SUMMARY OF BAND RETURN DATA

Region of State	Area of Concentration	Per Cent of Kill Based on Band Returns
North Louisiana	Caddo Parish—Caddo, Cross, Wallace Lakes	4.75%
	Bienville—Bossier Parish, Lake Bistineau	1.53%
	Natchitoches Parish—Black-Saline, Clear Lakes	3.56%
	Catahoula Lake	6.59%
	Ouachita—Union, Morehouse, near Monroe, Louisiana	6.97%
Total		23.40%
South Central Louisiana	Avoyelles, St. Landry, Point Coupee Section	4.30%
	Blind River—Maurepas swamp	0.90%
Total		5.20%
Coastal Marsh Area	Lake Charles area (Cameron, Calcasieu, Vermilion Parishes)	27.45%
	Rice Parishes (Allen, Jefferson Davis, Acadia, Evangeline)	9.19%
	Franklin—Morgan City—Houma area	11.17%
	New Orleans—Delta area	13.65%
Total		61.46%
GRAND TOTAL		90.06%

It is evident from the above table and map (Figure 28) that the duck kill away from the coast is highly localized and even along the coast there are certain regions that produce much better hunting than others. Since 90 per cent of the total duck kill evidently comes from the areas listed above, they are probably representative of the primary waterfowl range in the State. The results from band returns also indicate which regions of the State are getting the best kills.

Daily checks during the 1949-50 season by Yancey on Catahoula Lake, Black-Saline, Clear Lake, and Lake Bistineau indicated an over-all bag for his study areas of 20,507. A check of the number of band returns from these sample areas indicates that one band was returned for each 466 birds bagged. Since only 44 bands or approximately 10 per cent of the total band returns for the State came from the study area there is a possibility of considerable error in assuming that 466 is the average number of ducks killed for each band returned over the State. Nevertheless, a figure derived by this method is the nearest to a random sample that has been obtained thus far. A 2-year average of the band returns for the study areas was somewhat lower, being 30.5 bands per season. This, of course, could have been due to a smaller kill in 1949 and to the fact that more ducks were banded by 1950. If the 2-year average of band returns is divided into the estimated average 2-year kill, the result is approximately 600 ducks killed per band return. No matter which of these figures is used, if multiplied by the total band returns for north Louisiana, an approximate total kill is attained. By this method, an estimated maximum kill of 75,000 occurred in north Louisiana in 1950 with the minimum estimated as low as 59,000. When applied to the total band returns for the State, a maximum figure of no more than 213,800 waterfowl is found to be the kill for Louisiana in 1950, including an additional 18,000 added for parishes killing too few waterfowl to report band returns.

It is realized that many arguments may be advanced against this method of determining kill as not all bands are turned in, crippling loss is not considered, and illegal kill is not estimated. On the other hand, there is much to be said for this method. It certainly is purely a random sample and at least it shows trends of kill and locality accurately. All bands do not have to be turned in to get a reasonable kill picture. It is probable that the percent of bands returned to those shot and not returned, will be relatively the same over large areas like the State. In any case, the fewer bands returned the higher the kill ratio per band or vice versa for a given area. The same answer will be obtained so long as the band returns increase or decrease proportionally over the State. Therefore, for any given season, the ratio is as follows:

$$\frac{\text{Known Kill for Study Area}}{\text{Band Returns for Study Area}} \times \text{Total Band Returns} = \text{Total Kill.}$$

The band returns for a study area will give the approximate total kill. The accuracy of such a method is only controlled by the size of the kill on the study area and the number of band returns in relation to the State total. In this case, a 13 per cent sample was used which should result in a fairly reliable figure. None of the methods used in the State accounts for crippling loss or illegal kills.

This method is used here simply as another approach to the kill problem so that a clearer picture of the annual take may be had.

It is evident that the State kill estimates made by Brown (1948) and determined both by interview and band returns on this inventory are much smaller than the estimates of Federal authorities. No evidence can be found for waterfowl kills greater than 200,000 or an extreme maximum of 350,000 for the State and it is the considered opinion of this investigator that the lower figure is closer to the accurate one, at least for the past 2 years. As opposed to this, Federal authorities estimate an annual kill of some 900,000. It seems apparent that the average daily and season kill of good duck hunters in good areas is being applied to too great a segment of the waterfowl stamp holders. This is a natural error because hunters interviewed in the field particularly late in the season represent the diligent hunter. Also post-season inventories are made up of information chiefly from those interested in or known to be experienced duck hunters because such individuals are the only ones who are interested enough to answer questionnaires or who have information to give. Pure random sampling can never be attained by looking for duck hunters to question, but should be done on the basis of looking up and questioning a significant segment of duck stamp holders over the entire State. All information gathered on this study indicates that a few hunters favored with choice areas or belonging to clubs and a few who are diligent and expert enough to kill waterfowl under adverse conditions, account for most of the duck kill. The remaining hunters who want easy hunting or who can't afford to visit good areas kill practically none. This is not a characteristic of duck hunting alone. Thompson (1949) indicates that the same is true for quail hunting—i.e., some 30 per cent of the hunters make 70 per cent of the kill.

Under normal conditions with all hunters having an equal chance at waterfowl, under the law, the hunter effort might be rewarded equitably. In this State however, land restrictions, short seasons, small bag limits, and the setting of seasons favoring some sections tend to discriminate against a large segment of waterfowl hunters in Louisiana. Whether or not changes should be made is for higher authority to determine. It would seem only fair, however, that harsh restrictions, aimed at controlling a 900,000 annual kill in the State, could be lessened in view of the much smaller kill that seems to be occurring. It also is true that if kill estimates by Federal authorities for the entire flyway are as much greater in other areas as they seem to be in Louisiana, then the restrictions as based on kill estimates are much too harsh everywhere and should be remedied.

In all fairness, however, this present analysis is just as questionable as Federal estimates and may prove to be entirely wrong. The one thing that is abundantly clear is that much more detailed data for Louisiana and the entire flyway is essential. A program for obtaining this information in Louisiana is now in progress.

WATERFOWL KILL BY SPECIES

There are several sources of kill by species which make an interesting comparison and which are indicative of the gun pressure on the various species in Louisiana. Kill by species for the 6-year period 1941-1947 for hunting clubs on the coast has been published by Brown (1948). Yancey (1950) has done a bag check in north Louisiana and market hunting statistics were available for the years 1913-18. Table 72 shows the comparative take in percent of the total for all species and for the different periods. This table is based on the analysis of a total kill involving some 1,679,062 waterfowl which may be broken down as follows: market hunter take 1913-18, 1,276,286; hunting club take 1941-47, 382,269; and the 1950 kill of 20,500 on certain study areas in north Louisiana. An examination of Table 72 indicates a striking similarity between the kill of 35 years ago and the present, particularly on the coast. The up-state kill is not startlingly different though it does have greater wood duck and ringnecked duck kill. The popular mallard is well out in front as the most-killed species but, surprisingly, there has been practically no change in the per cent of this species killed over 35 years. A careful examination of the table will also show that there has been little change for most other species. It seems evident from the data on hand that decreasing population, changing seasons, small bag limits, and all other changes have not affected the relative vulnerability of the individual species over the years. This would tend to indicate that populations of the various species in relation to each other have changed little over the years. This is surprising because at first glance it would seem that a few species less sought-after, harder to kill, or given additional protection by the nature of their flight pattern in relation to the hunting season, would have a pyr-

TABLE 72

PERCENT OF WATERFOWL KILL BY SPECIES

	Mallard	Pintail	Gadwall	Widgeon	G. W. Teal	B. W. Teal	Shov-eller	Red-head	Canvas-back	Scaup	Ringneck Duck	Buffle-head	Coot	Geese	Miscel.	Wood Duck
Coastal Area[3]	42.46	11.52	5.32	......	8.30	......**	8.32	0.22	0.97	5.77	4.54	......	10.65	0.74		0.09
Coastal Area[1]	43.59	17.45	6 51	2.38	4.13	3.0	2.88	0.37	0.72	3.50	5.81	.35	4.21	3.19*	1.88	.....
North Louisiana[2]	50 52	4.79	1.88	......	7.17	0.26	1.86	0.26	1.56	0.97	18.32	0.26	5.31	......	0.95	5 74

[1] Represents a 6 yr. average on the coast.
[2] One year bag check.
[3] Market hunter bag check records 1913-14 to 1917-18.
* Blue geese make up 65% of all geese killed.
** All teal together.

amiding population that should eventually show up in the kill. This apparently has not happened thus far.

CONCLUSIONS & RECOMMENDATIONS

The waterfowl conditions in Louisiana as determined by this study from an analysis of all available information may be summarized as follows:

1. The total winter population in Louisiana is less than in former years because of three primary reasons: a lowering of the total national population, the loss of a large part of the present population which now winters in impoundments and flooded areas in States north of Louisiana, and a reduction of wintering range in the State because of drainage, second-growth cypress-tupelo forests, and the water hyacinth.

2. The quality of range and extent of range in north Louisiana is insufficient to hold large all-winter populations either in the face of gun pressure or, as in many cases, even without gun pressure.

3. The waterfowl flights for Louisiana do not fall within a December hunting season in the northern part of the State. If short seasons of 30 or 40 days must be complied with, the greater part of the month of November should fall within the season if Louisiana hunters are to receive universally good hunting.

4. The annual waterfowl population wintering in Louisiana is not exactly known but is probably between one and three million.

5. The annual kill is a controversial subject. Federal authorities claim nearly a million waterfowl are taken in the State. All evidence gathered on this project indicates less than 300,000 birds are killed and that it may be lower than this.

6. In view of such a low kill, there is some doubt that Louisiana is allowed a kill equitable with that of other States in the flyway, considering the extent of range and the number of ducks that use the area.

7. A study of annual kill by species does not show any marked change in the per cent of any species killed in relation to the total over the past 35 years.

8. Numerous recommendations could be made regarding changes in season, bag limits, and time of shooting in order to give Louisiana

hunters a more equitable kill. Such changes, however, are only within the authority of the Federal officials. Some recommendations that can be carried out by the State are as follows:

a. Increase the public shooting areas in an attempt to gain more land for public hunting in the marsh.

b. Develop all available areas in north and central Louisiana in order to hold more waterfowl in these areas.

c. Establish refuges, shooting on alternate days, or some types of controlled shooting on north Louisiana areas where ducks are being driven away by gun pressure. A smaller daily kill distributed more evenly over the entire season would give a larger total kill and satisfy more hunters, than one unlimited shoot on the opening day or week.

d. Maintain an annual study of waterfowl conditions, including census, bag checks, hunter effort, and all other information which can be used to aid the Federal authority in setting seasons, bag limits, and regulations.

FUR ANIMALS

The great economic importance of Louisiana's fur crop makes it necessary that a general wildlife inventory include some study of the fur producing conditions. Although fur animals are not generally considered game, from a game management standpoint, the fur bearers must be considered because they use the same range as many manageable game species. It is obvious that a game management plan for any area containing both fur and game animals will have to consider both since the fur bearers cannot be eliminated or ignored. Furthermore, some fur animals are predators and some are of considerable economic importance: a game management program should include both the study and the control of predators and marketable fur animals may be collected to aid in financing the plan.

The following discussion will involve a brief survey of Louisiana's fur production, the important fur animals, and the fur producing range.

THE FUR PRODUCING SPECIES

There are 13 potential fur producers, including the bear, cougar, and wolf which are now rare and not in demand on the market. The remaining 10 species making up the total fur crop of Louisiana are listed in Table 73.

Although the above table lists 10 species which are taken and sold for fur, some types are much more important than others. For example, muskrat, mink, raccoon, and opossum make up 99.6 per cent of the numerical catch and muskrat and mink alone account for 96.6 per cent of the total income from furs. Muskrats, the mainstay of the Louisiana fur industry, make up 93.9 per cent of the total catch and 80.4 per cent of the total income from fur. Mink are the second most valuable fur species because of both the abundance and the value of its fur.

Raccoon and opossum are numerous and would numerically make up a large part of the fur catch if their furs were of any value. Both species have not been in demand in recent years and prices are so low that trappers avoid catching them.

Otters have a very valuable fur, but are not very numerous nor have they been numerous enough during the past 50 years to make up a significant part of the fur catch of the State.

TABLE 73

FUR SPECIES COMMON TO LOUISIANA

COMMON NAME	SCIENTIFIC NAME	GENERAL RANGE IN STATE
MUSKRAT[1]	*Ondatra zibethicus rivalicius*	Confined to coastal marsh.
MINK[1]	*Mustela vison vulgivaga*	Wet, wooded areas of State, more common in the south.
RACCOON[1]	*Procyon lotor varius**	Entire State
OTTER[2]	*Lutra canadensis texensis*	Bottomlands and coastal marsh.
OPOSSUM[2]	*Didelphis virginiana virginiana*	State-wide.
NUTRIA[2]	*Myocastor coypus*	Confined to coastal marsh.
SKUNK[2]	*Mephitis mephitis mesomelas**	State-wide.
GRAY FOX[3]	*Urocyon cinereoargenteus floridanus**	Primarily confined to extensively wooded uplands.
BOBCAT[3]	*Lynx rufus floridanus**	In more densely wooded areas of the State.
BEAVER**	*Castor canadensis carolinensis*	Florida parishes and restocked areas.

* These types are represented by more than one subspecies.

** Season closed.

[1] The more important species. These make up the bulk of the fur crop.

[2] Either rare or not economically important.

[3] Miscellaneous types.

Nutria, a newly introduced species, is rapidly increasing and shows promise of becoming one of the important fur animals of the State. To date, however, it does not make up a large part of the fur catch. The remaining species listed must be considered miscellaneous as they do not constitute a large part of the catch nor are they in great demand.The beaver is listed here because, although a valuable fur animal, it came so near to extinction in the State that the season has been permanently closed.

Though the fur bearers are trapped over most of Louisiana's woodlands and marsh, the bulk of the fur crop comes from some 5,200,000 acres of marsh and cypress-tupelo swamps in the southern part of the State. Muskrat and nutria are almost exclusively confined to the marsh and the bulk of the mink and otter are from the same general areas. (See Figures 30 and 31.) Raccoon and oppossum are taken over the entire wooded areas of the

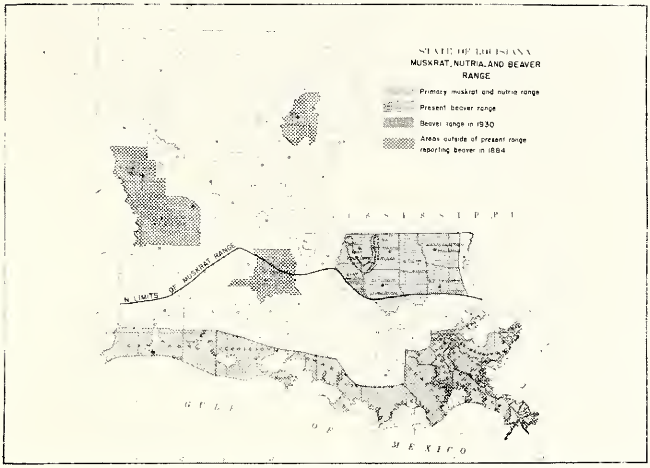

STATE OF LOUISIANA
MUSKRAT, NUTRIA, AND BEAVER RANGE
Primary muskrat and nutria range
Present beaver range
Beaver range in 1930
Areas outside of present range reporting beaver in 1884
N LIMITS OF MUSKRAT RANGE
MISSISSIPPI
GULF OF MEXICO

FIGURE 30

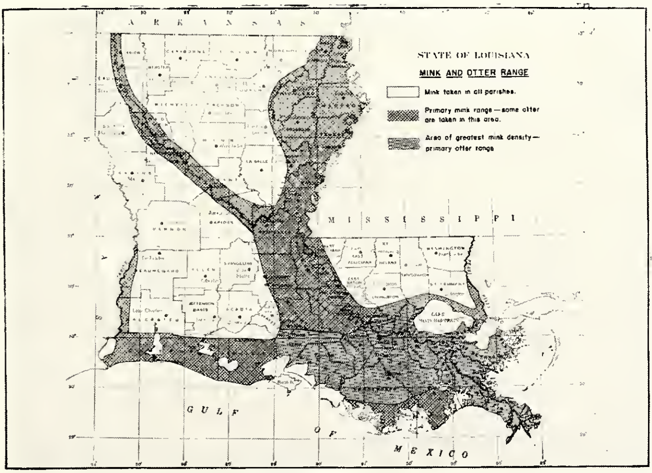

ARKANSAS
STATE OF LOUISIANA
MINK AND OTTER RANGE
Mink taken in all parishes.
Primary mink range—some otter are taken in this area.
Area of greatest mink density—primary otter range
MISSISSIPPI
GULF OF MEXICO

FIGURE 31

State, but are more common in bottomlands and creek bottoms. With the exception of beaver, the remaining animals are more or less evenly dispersed over the State although the fox (Figure 23) and bobcat (Figure 22) do not occur in the wetter areas to any great extent. Beaver now occur only in the Southeast Terrace Lands primarily along the Amite River and its tributaries. (Figure 30).

THE IMPORTANCE AND VALUE OF LOUISIANA'S FURS

Louisiana's fur crop is without peer in North America. More furs are taken in Louisiana than in any State in the United States or Alaska and its total muskrat production in peak years exceeds the production of all of the United States and Alaska. During the past 10 years, the average total production has exceeded 6,100,000 pelts. The following table compares the fur production in Louisiana in 1946, a peak year, to the remainder of the United States and Alaska during that same year.

TABLE 74

COMPARATIVE FUR TAKE

LOUISIANA, UNITED STATES, AND ALASKA[1]

	Total fur harvest number pelts	Muskrat only number pelts	Other furs	License sales	Take per license
U. S.* & Alaska	13,486,548	8,049,215	5,437,333	508,847	26.5
Louisiana	8,869,609	8,337,411	532,198	8,905	96.6

[1] These figures for 1946, a peak year. This ratio does not necessarily hold each year.

*Forty of forty-seven states besides Louisiana represented. Seven states not considered because fur production is small and records not available.

Although the above statistics represent a peak-producing year in Louisiana, it is indicative of the tremendous fur potential of this small area. The surprising part of the data is the volume of furs other than muskrat produced in the State. Louisiana's vast marshes give it a decided production advantage in regard to muskrat but the 532,198 other pelts taken exceeds every State and Alaska excepting Texas, which produces some 800,000 pelts besides muskrat. The Louisiana mink crop for this same year was nearly three times that of Alaska, exceeded all other States in the Union and was 26.8 per cent of the total catch in the United States.

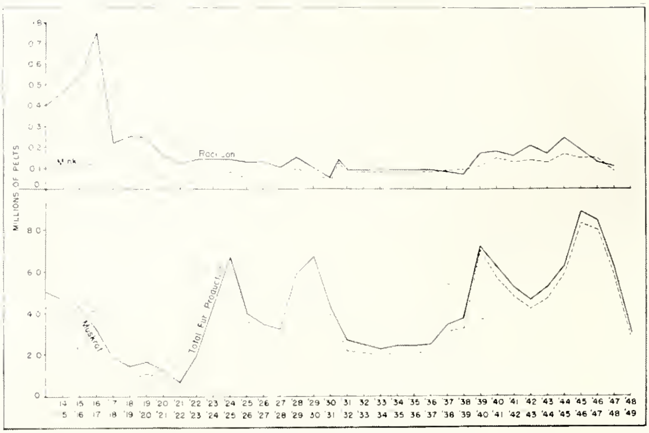
The incredibility of Louisiana's total fur production may be partially comprehended when it is realized that a pelt of some type is trapped off every 1.3 acres of range in the State during good years. The average for the past 10 years is one pelt per 1.96 acres of fur-bearing range, and one pelt for every 4.75 acres of the entire area of the State.

The value of Louisiana's fur crop is considerable as would be expected from such large catches. For the 18-year period, 1928 to 1946, the total annual sale of furs in the State averaged $4,755,000 and this included the extremely poor depression years. The average for the war years during high prices, but part of the time under price control, was $7,952,000. Table 75 lists the total catch by species, the selling price of each and the total for each year of this 18-year period.

It will be evident from the above table that the price of furs was extremely low during the depression years. Muskrats hit a low point of 26 cents and mink of low of $1.50 in the 1932-33 seasons. The total catch at this time may have been low in part because of the poor value of furs, but there is also evidence of a cyclic low between 1931 and 1937. (See Graph IX.)

The total value of Louisiana's furs is controlled by the price received for muskrat and mink. It would seem from the above table that if $1.00 or more per pelt is received for muskrat and $5.00 or more is received for mink an average to good season will be had.

The value of raccoon and opossum furs has been low since the late 1920's. Should these furs ever increase in demand enough to bring a good price, the annual value of the State's fur crop could be doubled.



LOUISIANA FUR PRODUCTION, 1913-1949

FIGURE 32, GRAPH IX

TABLE 75

COMPARATIVE TAKES OF FUR ANIMALS IN LOUISIANA FROM 1914 TO 1949 AND COMPARATIVE ANNUAL RECEIPTS FOR THE YEARS 1929-46

	1913-14	1915-16	1916-17	1917-18	1918-19
Muskrat	4,284,000	3,500,420	2,125,000	1,387,220	963,110
Raccoon	401,000	532,480	678,821	220,110	258,200
Opossum	178,000	193,640	228,921	140,125	152,800
Mink	105,000	114,620	122,480	85,440	79,975
Skunk	27,280	23,670	25,624	25,210	22,340
Otter	2,860	3,540	6,940	1,985	2,428
Fox, Wolves, & Civet Cats	4,500	6,740	13,164	3,100	3,700
Totals	5,002,640	4,375,110	3,200,950	1,863,190	1,482,553

	1919-20	1920-21	1921-22	1922-23	1924-25
Muskrat	1,073,200	900,170	465,766	1,682,571	6,236,165
Raccoon	252,800	160,683	119,129	140,884	145,810
Opossum	224,100	131,553	103,078	99,119	287,180
Mink	98,700	66,315	36,885	31,461	84,201
Skunk	13,300	12,322	6,934	11,300	14,752
Otter	1,680	321	278	530	2,110
Fox, Wolves, & Civet Cats	2,365		2,491	3,037	947
Total	1,666,145	1,271,364	734,561	1,968,902	6,771,165

	1925-26	1926-27	1927-28
Muskrat	3,613,765	3,036,749	2,858,834
Opossum	198,490	356,184	339,210
Raccoon	128,516	127,882	103,544
Mink	51,447	43,896	67,284
Otter	2,024	2,554	1,190
Skunk	30,866	27,671	22,348
Miscl. Pelts	1,058	1,095	1,072
Total	4,026,166	3,596,031	3,393,482

TABLE 75—(Cont'd)

COMPARATIVE TAKES OF FUR ANIMALS IN LOUISIANA FROM 1914 TO 1949 AND COMPARATIVE ANNUAL RECEIPTS FOR THE YEARS 1929-46

		1928-29 Season		
Muskrats	5,105,374	@	$ 1.15	$5,871,180.10
Opossums	518,295	@	1.10	570,124.50
Raccoons	153,914	@	7.25	1,115,876.50
Minks	99,844	@	8.50	848,674.00
Skunks	31,661	@	1.25	39,576.25
Spotted Skunks	7,279	@	1.25	9,098.75
Otters	3,048	@	22.00	67,056.00
Wild Cats	865	@	2.00	1,730.00
Foxes	1,476	@	2.00	2,952.00
Miscellaneous	314	@	1.50	471.00
Total	5,922,070			$8,526,739.10
		1929-30 Season		
Muskrats	6,269,556	@	$ .60	$3,761,733.60
Opossums	309,363	@	.75	232,022.25
Raccoons	105,381	@	3.50	368,833.50
Minks	69,680	@	5.00	348,400.00
Otters	1,447	@	11.50	16,640.50
Skunks	27,034	@	.60	16,220.40
Miscellaneous	1,877	@	1.00	1,877.00
Total	6,784,338			$4,747,727.25
		1930-31 Season		
Muskrats	4,068,114	@	$ .40	$1,627,245.60
Opossums	127,725	@	.40	51,090.00
Raccoons	52,065	@	3.00	156,195.00
Minks	45,390	@	3.00	136,170.00
Otters	1,396	@	12.00	16,752.00
Skunks	11,487	@	.50	5,743.50
Miscellaneous	1,472	@	1.00	1,472.00
Total	4,307,649			$1,994,668.10
		1931-32 Season		
Muskrats	2,209,382	@	$ .32	$ 707,002.24
Opossums	197,712	@	.15	29,656.80
Raccoons	133,470	@	1.50	200,205.00
Minks	127,245	@	3.50	445,357.50
Otters	1,664	@	8.00	13,312.00
Skunks	122,679	@	.30	36,803.70
Miscellaneous	3,117	@	.50	1,558.50
Total	2,795,269			$1,433,895.74
		1932-33 Season		
Muskrats	2,150,915	@	$ .26	$ 559,237.90
Opossums	127,890	@	.15	19,183.50
Raccoons	87,674	@	.80	70,139.20
Minks	82,364	@	1.50	123,546.00
Otters	870	@	5.00	4,350.00
Skunks	52,349	@	.08	4,187.92
Miscellaneous	2,159	@	.50	1,079.50
Total	2,504,221			$ 781,724.02
		1933-34 Season		
Muskrats	2,025,915	@	$ .58	$1,175,030.70
Opossums	123,540	@	.30	37,062.00
Raccoons	85,764	@	1.25	107,205.00
Minks	81,463	@	2.25	183,291.75

TABLE 75—(Cont'd)

COMPARATIVE TAKES OF FUR ANIMALS IN LOUISIANA FROM 1914 TO 1949 AND COMPARATIVE ANNUAL RECEIPTS FOR THE YEARS 1929-46

1933-34 Season—(Cont'd)

Otters	780	@	7.00	5,460.00
Skunks	50,959	@	.20	10,191.80
Miscellaneous	2,557	@	.60	1,534.20
Total	2,370,978			$1,519,775.45

1934-35 Season

Muskrats	2,125,720	@	$ .65	$1,381,718.00
Opossums	126,000	@	.35	44,100.00
Raccoons	83,467	@	1.85	154,413.95
Minks	80,364	@	3.25	261,183.00
Otters	789	@	10.00	7,890.00
Skunks	47,955	@	.22	10,550.10
Miscellaneous	2,415	@	.70	1,690.50
Total	2,466,710			$1,861,545.55

1935-36 Season

Muskrats	2,100,550	@	$ .80	$1,680,440.00
Opossums	125,830	@	.25	31,457.50
Raccoons	84,321	@	2.70	227,666 70
Minks	82,465	@	5.00	412,325.00
Otters	650	@	7.00	4,550.00
Skunks	 45,947	@	.25	11,486.75
Miscellaneous	2,503	@	.50	1,251.50
Total	2,442,264			$2,369,177.45

1936-37 Season

Muskrats	2,200,520	@	$ 1.00	$2,200,520.00
Opossums	128,000	@	.28	35,840.00
Raccoons	86,500	@	3.00	259,500.00
Minks	81,530	@	10.00	815,300.00
Otters	780	@	9.00	7,020.00
Skunks	46,890	@	.20	9,378.00
Miscellaneous	2,600	@	.50	1,300.00
Total	2,546,820			$3,328,858.00

1937-38 Season

Muskrats	3,110,540	@	$ .45	$1,399,743.00
Opossums	131,000	@	.12	15,720.00
Raccoons	87,300	@	1.25	109,125.00
Minks	82,480	@	5.25	433,020.00
Otters	920	@	7.00	6,440.00
Skunks	48,500	@	.12	5,820.00
Miscellaneous	2,700	@	.15	405.00
Total	3,463,440			$1,970,273.00

No audit for 1938-39 Season

1939-40 Season

Muskrats	7,034,661	@	$ .60	$4,220,796.60
Opossums	54,354	@	.10	5,435.40
Raccoons	77,446	@	1.40	108,424.40
Mink	92,061	@	3.00	276,183.00
Otters	1,392	@	6.60	9,187.20
Skunks	5,739	@	.10	573.90
Foxes	1,870	@	.50	935.00
Civet Cats	144	@	.50	72.00
Miscellaneous	235	@	.50	117.50
Total	7,267,902			$4,621,725.00

TABLE 75—(Cont'd)

COMPARATIVE TAKES OF FUR ANIMALS IN LOUISIANA FROM 1914 TO 1949 AND COMPARATIVE ANNUAL RECEIPTS FOR THE YEARS 1929-46

1940-41 Season

Muskrats	5,317,126	@	$ 1.00	$5,317,126.00
Mice	461,624	@	.10	46,162.40
Raccoons	169,531	@	1.00	169,531.00
Minks	114,323	@	4.00	457,292.00
Opossums	131,045	@	.10	13,104.50
Skunks	15,499	@	.10	1,549.90
Otters	1,728	@	5.00	8,640.00
Foxes	3,768	@	.50	1,884.00
Civet Cats	227	@	.50	113.50
Miscellaneous	1,715	@	.50	857.50
Total	6,216,586			$6,016,260.80

1941-42 Season

Muskrats	4,511,596	@	$ 1.00	$4,511,596.00
Mice	334,896	@	.10	33,489.60
Minks	155,391	@	4.00	621,564.00
Raccoons	181,309	@	1.50	271,963.50
Opossums	128,027	@	.30	38,408.10
Otters	1,760	@	6.00	10,560.00
Skunks	20,880	@	.40	8,352.00
Foxes	4,446	@	.50	2,223.00
Civet Cats	399	@	.50	199.50
Miscellaneous	4,027	@	.50	2,013.50
Total	5,342,731			$5,500,369.20

1942-43 Season

Muskrats	3,947,083	@	$ 1.18	$4,657,557.94
Mice	306,314	@	.10	30,631.40
Minks	128,311	@	4.00	513,244.00
Raccoons	164,695	@	2.00	329,390.00
Opossums	78,738	@	.35	27,558.30
Otters	1,399	@	7.50	10,492.50
Skunks	17,349	@	.75	13,011.75
Foxes	3,727	@	1.25	4,658.75
Civet Cats	231	@	.15	34.65
Miscellaneous	48	@	.50	24.00
Total	4,647,895			$5,586,603.29

1943-44 Season

Muskrats	4,440,793	@	$ 1.44¾	$6,428,047.87
Mice	302,997	@	.10	30,299.70
Minks	144,582	@	4.05	585,557.10
Raccoons	208,010	@	1.15	239,211.50
Opossums	91,033	@	.50	45,516.50
Otters	2,404	@	6.00	14,424.00
Skunks	28,037	@	.50	14,018.50
Foxes	8,534	@	.50	4,267.00
Cats	918	@	.50	459.00
Miscellaneous	1,582	@	.50	791.00
Total	5,228,890			$7,362,592.17

1944-45 Season

Muskrats	5,577,216	@	$ 1.23	$6,859,975.68
Mice	385,940	@	.10	38,594.00
Minks	132,821	@	4.05	537,925.05
Raccoons	176,911	@	1.15	203,447.65
Opossums	66,000	@	.50	33,000.00

TABLE 75—(Cont'd)

COMPARATIVE TAKES OF FUR ANIMALS IN LOUISIANA
FROM 1914 TO 1949 AND COMPARATIVE ANNUAL
RECEIPTS FOR THE YEARS 1929-46

1944-45 Season—(Cont'd)

Otters	1,912	@	6.00	11,472.00
Skunks	11,155	@	.50	5,577.50
Foxes	5,124	@	.50	2,562.00
Cats	628	@	.50	314.00
Miscellaneous	988	@	.50	494.00
Total	6,358,695			$7,693,361.88

1945-46 Season

Muskrats	8,337,411	@	$ 1.50	$12,506,116.50
Nutria	8,784	@	5.00	43,920.00
Minks	168,598	@	15.00	2,528,970.00
Raccoons	244,502	@	1.50	366,753.00
Opossums	90,433	@	.50	45,216.50
Otters	2,367	@	20.00	47,340.00
Skunks	12,224	@	1.00	12,224.00
Foxes	3,823	@	.50	1,911.50
Cats	1,430	@	.50	715.00
Miscellaneous	37	@	.50	18.50
Total	8,869,609			$15,553,185.00

	1946-47	1947-48	1948-49
Fox	2,645	2,528	1,727
Mink	153,027	153,061	91,541
Muskrat	8,029,764	5,895,459	2,948,281
Nutria	18,015	28,173	26,738
Opossum	77,264	31,744	23,713
Otter	2,832	5,078	2,222
Raccoon	186,750	126,933	104,034
Skunk	4,830	1,415	1,144
Cat	383	69	222
Miscellaneous	53	679	764
Total	8,475,563	6,245,139	3,200,387

In final analysis, Louisiana's fur harvest and sale is a big business and is the most important commercial segment of the Department of Wildlife and Fisheries. Because of this, every care should be taken to maintain the State's fur production. Each of the fur bearers has certain characteristics, food habits, and ecological requirements which govern its range and production and which will also govern its management. To present a detailed report of such material would require extensive investigation of each animal. In O'Neil's study of the muskrat, it required 4 years and an entire volume to present the findings. In view of the importance of the fur industry to Louisiana, it is believed that similar studies of the mink, otter, and possibly raccoon are also warranted. In this discussion, only those general factors known to control range and production will be discussed.

MUSKRAT

Ondatra zibethicus rivalicius

The muskrat, which is the mainstay of the Louisiana fur industry, has been thoroughly investigated by O'Neil (1949). His findings were many and cannot be reviewed here in detail. Only the basic factors controlling muskrat and their management will be discussed.

RANGE:

The semi-aquatic habits of the muskrat require a considerable amount of water on its range. In many parts of the United States this animal is found in all small ponds, lakes, swamps, and streams. In Louisiana, however, the muskrat is confined to the coastal marsh and its environs. (See map, Fig. 30). The apparent reason for this inability of the muskrat to spread all over the State is the extreme and frequent fluctuations of water levels which occur in most of the streams and lakes of Louisiana. High waters destroy the bank burrows of the rat and drown the young. Muskrats do well in lakes with stable water levels in all parts of the State. The total range of the muskrat in Louisiana consists of possibly some 4,500,000 acres in the coastal area, most of which is marsh. The bulk of the best producing range is confined to some 2,940,000 acres of brackish-water marshes where three-cornered grass, (*Scirpus* spp.), a choice muskrat food, is plentiful.

POPULATIONS AND FACTORS CONTROLLING MUSKRAT POPULATIONS:

According to O'Neil, the fantastic muskrat population occuring in the Louisiana marsh is primarily a phenomenon of the ecology of the marsh and the food habits of the rat. As indicated earlier in this report in the ecological section, the coastal marsh may be divided into the Delta, Sub-delta, and Prairie sections and these may be further sub-divided into fresh, brackish, and salt marsh zones. (See map–Fig. 12 and Table 23). Each of these zones produces different plant species some of which are more suitable for muskrat food than others. The brackish water zone of all sections of the marsh produces brackish water, three-cornered grasses (*Scirpus olneyi* and *S. robustus*), the choice foods of the muskrat.

Muskrat eat numerous types of vegetable and animal matter but the quantity of choice foods available limits the populations. It is evident from a study of muskrat catches over the years (Table 75 and Graph IX) that populations rise and fall in a cyclic manner. O'Neil has found that the primary cause of this cycle is the establishment of large amounts of food because of ecological changes, the rise of muskrat populations after the food appears, and the eventual crash of the peak populations as all of the food is consumed by the rapidly producing rats. Three-cornered grass is the muskrat food that builds up the peak populations. This plant is sub-dominant to the climax type wiregrass (*Spartina patens*) and will completely dominate the large marsh areas if the wiregrass is removed. When nature or man-made changes, such as a combination of burning and high salt tides, kill off the wiregrass, then three-cornered grass takes over and blankets the area. When this occurs, the muskrat population begins to soar until it reaches the proportion of several rats to the acre with more being rapidly produced. At this point, the rats will soon eat up all of their food and the result is a muddy, "eaten-out" area unable to sustain more than a minimum of rats. (See Plate 23.) The resulting crash in population is a natural occurrence at such times and another peak is reached only after the food is restored. Such cyclic peaks occur in periods of from 10 to 14 years on the best areas and over a longer period in others. The length of the cycle is dependent upon the ecology of the area which governs the rate at which an "eat-out" can be re-sodded by three-cornered grass.

MANAGEMENT:

According to O'Neil, the management of muskrat in the marshes involves the production of three-cornered grass and then extensive trapping to prevent over-population. The three-cornered grass marsh can be man-made by the proper manipulation of water levels and by periodic burning. The first burning should be undertaken during the first two weeks in October in order to get the equinoctial tides on the burned area and to have the grass from 12 to 14 inches high by the trapping season. Not all of the marsh should be burned at once. Sixty per cent should be burned in October, 20 per cent about December 1 and the remainder after the second burn has grass 8 to 10 inches high.

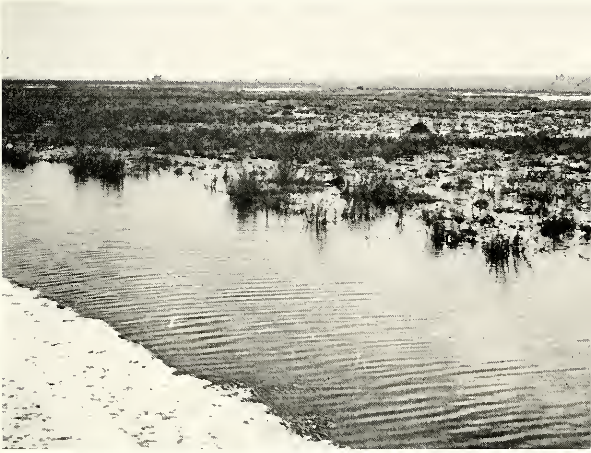


PLATE 23-a

A muskrat "eat-out". Note destruction of practically all vegetation. populations decline rapidly when such a condition occurs. Compare to Plate

PLATE 23-b

A typical three-cornered grass marsh *(Scirpus olneyi)*. This is excellent range but may be destroyed by high muskrat populations. See Plate 23-a.

Once a *S. olneyi* marsh is established, every effort should be made to prevent the muskrats from overpopulating the area. This means close and careful supervision of trapping to take off animals faster than the population increases. The idea is to achieve a lower but steady yield over a long period rather than one peak trapping season every 10 or 15 years. If such a management procedure can be widely introduced over the entire muskrat-producing area, the extremes of each cycle of muskrat production in Louisiana should be leveled off to a great extent.

MINK

(Mustela vison vulgivaga)

RANGE:

The mink, although not as aquatic in nature as the muskrat or otter, nevertheless prefers the presence of water and ranges almost exclusively along streams and lake banks in the wetter swamp areas and in the coastal marsh. Although populated mink range is found in nearly every parish in the State, the bulk of the range is in the bottomland hardwood areas and the coastal marshes. (See Figure 31.) By far, the best producing sections of the range are the cypress-tupelo swamps of south Louisiana and the fresh and brackish water sections of the marsh. The entire mink range in the State consists of parts of some 12,000,000 acres but the better portion in the southern part of the State does not exceed 5,000,000 acres on which is produced at least 85 per cent of the State mink crop.

Just why the better ranges of Louisiana produce so well is not clear. The State has had a steady production of around 100,000 mink pelts for 38 years and it has increased during the past 10 years. (See Graph IX, Table 75.) An examination of the range discloses ideal conditions of runs and food but many other States in the south seem to have similar areas yet they do not produce. For example, Florida has miles of waterways and swampy areas yet reports no mink catch and Georgia with large cypress-tupelo areas reports catches of only 2,000 to 6,000. In Louisiana, St. James Parish alone produces between 10,000 and 14,000 mink annually. Aside from the miles of waterways and low areas in Louisiana, the only range condition that might account for the large population of mink would be an unusually large quantity of food, particularly the crayfish. There is some evidence that the crayfish is the food item of choice in the cypress-tupelo areas in that its occurrence in great quantity throughout the swamps of Louisiana may be the reason for the large populations of milk and other Crustacea-eating fur bearers.

In recent years, coincident with the return of large numbers of white ibis to certain swamps the mink catch has dropped. Trappers of long-standing blame this crayfish-eating bird for the decline in mink saying they eat all of its food supply. Gowanloch (1950) indicates there may be considerable truth in their observations. It is quite evident that a study of this condition would be of value to the fur industry of the State, because it should disclose whether the white ibis is a limiting factor and also the reason for such areas producing so well when there are no ibis present.

In final analysis the mink ranges of this State must be recognized as among the best producing areas in the country.

MINK POPULATION AND DENSITY:

The total population of mink in Louisiana is not known, but catch records indicate that the average annual take has exceeded 95,000 for the past 37 years and 137,000 for the past 10 years. (See Table 75 and Graph IX.) Trappers and fur buyers long familiar with specific areas estimate that on the better producing range about 66 per cent of the total population is caught each season. If this is true, the total mink population has been quite stable over the years and does not seem to have been hurt by trapping. Graph IX indicates that catches have gradually increased since 1938 and that there has not been an extremely bad year since 1930, when only 45,000 skins were taken.

The density of the mink population varies from area to area as indicated by the acres per pelt production. The over-all State average is 1 pelt taken per 71 acres in good years and 1 in 131 acres in bad years. Good cypress-tupelo areas in St. James, St. John, Livingston, and Tangipahoa Parishes produce 1 pelt in 5.9 to 10 acres. (See Table 76.) This is probably the best production in the State. Average to good swamp range produces about 1 pelt to 25 or 30 acres in south Louisiana. In the northern part of the State, there are fewer mink as evidenced by catches of 1 to 60 acres and 1 to 150 acres in West Carroll and Concordia Parishes respectively; these represent better areas in better-drained bottomlands. (See Table 76.)

Conclusions and Recommendations:

Louisiana's mink production is a valuable resource of this State. The mink range and present production is the best in the United States and increases in population during the past 10 years indicate that it is not being over-trapped.

The value of the mink-trapping industry warrants that mink conditions and management should be given a maximum of attention and supervision. It is recommended that a study of the mink be made similar to that that has been made for the muskrat. Special attention should be given to areas where populations seem to be declining, to the regulation of trapping seasons according to populations, and to developing a management system for maximum production.

NUTRIA

(*Myocastor coypus*)

The nutria, a native of Argentina, was introduced into Louisiana in 1937 by E. A. McIllhenny of Avery Island. This animal, weighing between 18 and 25 pounds, is about the size of a beaver and resembles one except for a round tail. It bids fair to becoming a new fur animal in the State.

Nutria produce three or four litters of young annually and this rapid rate of reproduction has resulted in their spread to many parts of the coast from Avery Island. According to O'Neil (1949), nutria eat coarser vegetation than muskrats and show no sign of seriously competing with the muskrat for food in the coastal area. Alligator weed (*Alternanthera philoxeroides*), one of the pests of the State's water ways and lakes is a preferred food of the nutria. Some people have attempted to exploit this fact and have offered to introduce nutria into lakes and ponds as a weed control measure—at a price of course. There is some evidence that these animals may keep down weedy growths in ponds or lakes but not enough is known about them to advocate unrestricted stocking or to guarantee that they will remove unwanted vegetation. When exotic animals have been introduced into an area, there is always danger that they will do more damage than good. They may compete directly for food with native animals, bring in new diseases, or increase so rapidly, since they have no natural enemies, that they become a pest. For these reasons, most biologists look askance at introducing a new species without considerable and careful study of the animal. In the case of nutria, there is no evidence yet that damage will occur but should it become evident that they are detrimental, it is now too late to exterminate or control economically all of these animals in the State. It is of utmost importance that the nutria be studied in some detail in order to have a complete working knowledge of the habits of this animal. Such information would be of great value should this animal need to be controlled or should they begin to damage the muskrat industry of Louisiana.

On the other hand, nutria may prove to be a fair adjunct to the fur industry of the State. The total catch increased from 902 in 1944-45 to 26,738 in 1948-49. According to O'Neil (1949), nearly three times this number of nutria may have been caught and discarded because the skins were too small. According to him, trappers should stop trapping an area as soon as immature animals begin to be taken. Only large skins are desirable because they need to be plucked and sheared, which is an expensive process. The average price of nutria pelts is about $5.00, which places them fairly high on the market. It is evident that nutria could become very important to the fur industry of the State if these prices hold up.

OTTER

(*Lutra candensis texensis*)

The otter, a web-footed, semi-aquatic animal, occurs primarily in the wet areas of swamps, streams, and marshlands along the coast. Lowery (1943) thinks that this animal might have once ranged over the State and probably a few did occur in almost all parishes of the State. The position of the otter as a fur bearer in Louisiana is peculiar. Although the State produces more otter skins than any other State or Alaska, the number, which averages about 1900 annually, is quite small when compared to 95,000 for mink, an animal of somewhat similar habits. The reason for this large otter to mink ratio is not clear, but all catch records here and from other areas indicate it to be an apparently normal condition. The otter, like the mink, eats fish and crayfish, of which there is an abundant supply in Louisiana, and they use much the same range. It would seem from this that otter populations should be comparatively large, yet they are not. It is possible that the difference in the rate of reproduction is a primary limiting factor to high otter populations since they produce only 1 to 3 young while mink average 5 or 6 young per litter. Both animals are reported to produce only one litter a year. Other factors that might influence the size of the otter population are its tendency to live in bank burrows that might be endangered in areas where waters fluctuate frequently and the fact that the nature of the otter requires a greater range. None of these factors seems to explain fully why the otter catch averaged only 1,900 annually as compared to 95,000 for mink over a 38-year period. Another peculiar fact is that annual otter catches over the years ranging from a low of 278 pelts to a high of 6,940 do not necessarily coincide with the low and high points of mink production. Many good otter catches have occurred in years when mink populations were at a minimum. Perhaps it may be only of academic interest, but any study of fur bearers in Louisiana should include a study of the factors controlling the otter-mink ratio.

The exact otter population is not known. Trappers estimate about 40 per cent of the total is taken each season. This would mean that the total State population ranges from as low as 1,000 to as high as 10,000 but has averaged around 3,100 for the past 38 years. Table 76 shows the average otter pelt production per unit area. A pelt to 474 acres is the highest production attained while the State average ranges from 1,034 acres to 2,738 acres per pelt. Although the fact that the total otter population in the State is only a few thousand, there is no evidence that the trend is downward or that trapping is hurting this fine fur animal. An examination of Table 75 will show that the catches during the past 10 years have been as good or better than at any time during the past 38 years. In fact, the 5,078 pelts taken in 1948 is the second highest catch that has ever been recorded for the State.

CONCLUSION AND RECOMMENDATIONS:

Otters are not numerous in Louisiana, but more are trapped here than in most of the United States and Alaska. The average price received for this fine fur is high enough to make the otter a substantial part of the fur income in the State. Although the population in the State is stable and seems to be little affected by trapping, so little is known of this valuable fur animal that a study of it should be undertaken.

RACCOON

(*Procyon lotor varius*)

AND OPOSSUM

(*Didelphis virginiana virginiana*)

The raccoon and opossum are the two most common fur bearers in the State and are state-wide in occurrence. Raccoon are especially abundant since most forms of night hunting have been declared illegal and the low price of its pelt prevents serious trapping. In many areas they are so abundant as to constitute a nuisance.

TABLE 76

FUR PRODUCTION IN THE STATE AND ITS VARIOUS AREAS

Area	Muskrat	Mink	Raccoon	Otter	Opossum
Total State[2]	0.47*	71.16*	49.07*	1,031.00*	136.68*
Total State[3]	1.33	131.07	115.33	2,738.00	506.01
Blind River Swamp (Lutcher-More)	......	14.60[1]	15.70	......	......
Blind River Swamp (Lutcher-Moore)[3]	......	18.60	19.60	......	......
St. John, Tangipahoa, Livingston[4]	......	9.50[1]	14.30	719.0	......
St. James[2]	......	5.90[1]	7.9	474.0	......
St. James[3]	......	7.90[1]	7.9	1,266.0	......
St. Tammany[4]	......	29.40	......	......	......
West Carroll	......	60.00	......	......	......
Concordia[2]	......	150.00	......	......	......
Marsh Island Refuge[2]	0.54	166.0	79.3	3,590	......
State Wildlife Refuge[2]	0.54	240.0	96	2,166	......
Rockefeller Refuge[2]	2.58	98.8	78.3	12,285	......
Pass-a-Loutre[2]	10.6	......	......	......	......

[1] These areas overlap and it is not clear just which figure represents the average for the total area. They also represent two sources of figures i.e., fur buyers report and trappers excise tax report.

Production in:

[2] Good year.

[3] Poor year.

[4] Average.

* Production in acres per pelt.

It is virtually impossible to estimate the raccoon and opossum populations in the State. Fur records for the past 38 years (Table 75) are not indicative of the total population except possibly prior to 1930 when opossum and raccoon skins were in demand and prices up. Since that time, trappers have actually avoided trying to catch these two animals but they still catch, even incidentally, greater numbers of each than they do mink. (See Table 75.) Most trappers claim the raccoon to mink ratio is from 5 to 1 to as high as 20 to 1. If this is true, the total raccoon population may exceed a million or even approach two million. Opossum apparently are not quite so numerous as raccoon.

The great numbers of raccoon in the coastal areas have caused the trappers so much trouble that the Department of Wild Life and Fisheries has outlawed them in that area, and they may be taken at all times. In the opinion of this investigator, something should also be done about the high raccoon population in other parishes of the State. It is not believed that so drastic a move as outlawing this species is needed, but certainly liberal night hunting laws would once again offer an excellent sport to the hunters of the State and at the same time bring about a population reduction that is badly needed. Any great demand for raccoon skins and a sharp increase in the price of this fur would also have the same effect, but such may not happen in the near future, if at all.

BEAVER

(*Castor canadensis carolinensis*)

The beaver, once a valuable fur and food animal cannot be legally trapped in the State at the present time. This animal, easily trapped, eagerly sought for food and fur, and probably never extremely numerous, was brought to near extinction by 1918. Arthur (1928) and Lowery (1936) report beaver to be present only in a restricted section of the Florida parishes on the Amite and Comite Rivers during the late twenties and early thirties. The few small colonies living on the upper reaches of the Comite and Amite Rivers were apparently the only beaver left in the State at that time, with the possible exception of one colony in Caldwell Parish. Although the beaver population reached its lowest point some time during the nineteen twenties and early thirties, the population had been low since the mid-nineteenth century and they were placed on the protected list as early as 1918. Unauthenticated reports dated about 1884 show the presence of beaver in only ten parishes; all but four of these were in the Florida Parishes where beaver still occur. (See map–Fig. 30.)

The four parishes then reporting beaver that do not have them now were Franklin, St. Landry, Sabine, and Vernon. Lowery (1943) reports a record showing beaver near Sicily Island in Catahoula Parish in 1850, which would tend to authenticate reports of their presence in Franklin Parish and along the Macon Ridge in 1884. The reported presence of beaver in Vernon and Sabine Parishes as late as 1884 indicates that at one time they were probably fairly common over most of the southwest terrace or pinelands. This is reasonable to believe in view of the fact that they have only been able to survive in the quite similar southeast terrace lands.

PRESENT DISTRIBUTION AND EXTENSION OF RANGE:

Since beaver were placed on the protected list in 1918, they have gradually multiplied and extended their range. Since the early 1930's they have moved from the extreme upper reaches of the Comite and Amite Rivers throughout the entire lower Amite River system and into the Tickfaw, Tangipahoa, Tchefunte, and parts of the Bogue Chitto and Pearl River systems.This movement was aided by live-trapping beaver in the Amite system and restocking some of the more eastern streams. (See map–Fig. 30.)

Along the Comite and Amite above Denham Springs, beaver are quite numerous and beaver signs are commonplace. In recent years, a considerable amount of complaint about beaver damage has occurred from landowners and farmers of East Baton Rouge, East Feliciana, and St. Helena Parishes. In some instances, beavers have built dams and flooded farm land and in others they have destroyed and eaten crops, especially corn. Campbell (1937) made a survey of beaver distribution and damage in this general area and found that most of the damage was exaggerated and in no case sufficient to warrant destruction of the beaver. In a more recent study, Thigpen (1950) came to the same conclusion.

On this survey, only evidence toward extension of the range and general conditions were determined. Except for the colonies in the Florida Parishes only one other was found in Caldwell Parish. Perkins (verbal communication) verified their presence in this area by observing cuttings.

Thigpen's (1950) studies of the beaver are the best that have been done in the State and represent a good start toward supplying much-needed information of this animal. He found that dams were built only in silt bottom streams that offered a coating for the sticks used in dam making. Beaver were generally not found on small, shallow, sandy, and gravelly streams, but larger streams of such type with water of sufficient depth were used extensively since bank burrows could be made and dams were not necessary.

According to Thigpen, some 33 species of trees, shrubs, and vines are used as food, but beaver prefer sweetgum and spruce pine. In most instances, trees were not felled but usually only girdled, sometimes quite high up on the trunk. Beaver did not travel very far in search of food and no evidence was obtained indicating serious damage to timber.

No attempt has been made to census the beaver. Both workers on this inventory and Thigpen found evidence of many colonies as well as numerous signs throughout the Amite River system. In other river systems, their presence is obvious, but signs are not nearly so numerous. Thigpen observed that the population may be frequently over-estimated because of the vast amount of work a few beaver are able to do.

Regardless of total number of beaver, if only half of the colonies on the Amite and Comite rivers were trapped out for restocking it is doubtful if a local decrease would be very noticeable. On one trip on the Amite river this investigator saw beaver signs on every sandbar for a distance of several miles. The frequency of signs on the Comite would also indicate that this animal must be along its entire course in considerable number. Beaver signs were seen near a drainage canal near LaPlace, Louisiana; this indicates these animals have moved some 50 or 60 miles down the Amite since the early 1930's.

Conclusion and Recommendations:

The beaver population of the State is primarily confined to the Florida parishes. It has increased under protection so that there are more than enough beaver in some areas to furnish stock for other parts of the State. In view of the importance of this animal the following recommendations are made:

1. Determine exactly where and how many beaver may be trapped for restocking by making a detailed census of colonies and individuals.
2. Include a survey of the State for suitable release areas in this study.

3. Devise a method of indexing the rate of spread in order to check population increase so that limited trapping may be had in the future.

MISCELLANEOUS FUR BEARERS

The fur bearers of least importance in Louisiana make up a heterogeneous group consisting of the skunks, the foxes, and the various cats. Because of the low value of most of these furs and the general scarcity or difficulty of trapping all excepting the skunk, few of this group are caught. An examination of Table 75 will indicate that 10,000 to 20,000 skunks, 2,000 to 5,000 foxes, and a few hundred cats represent the average annual catch. The economic importance of this group is small, making up only 1 or 2 per cent of the total fur income of the State.

The total number of these animals in the State is not known but it is certainly greater than the trapping records would indicate. Foxes are quite numerous in all of the uplands of the State, and the skunks are extremely abundant in the Mississippi River bottomland areas. The bobcat population in Louisiana is not known, but trapping results by predator-control men on areas of a known acreage indicate that a density of 1 cat to 1,500 acres may be expected in typical, heavily populated areas.

It is unfortunate that the demand for the fur of these animals is not greater since all are predators to some extent and more intense trapping for commercial purposes would tend to keep them in control. Predator-control units can, in some measure, maintain partial control of the less numerous types on restricted areas, but it cannot be hoped that skunks and foxes can be controlled by a few trappers.

It is evident from an examination of the statistics of catches and fur prices in Table 75 that this small group of miscellaneous fur bearers do not at present constitute an important part of the fur industry. Recommendations toward the management of these types are not necessary at this time.

THE ANNUAL FUR PRODUCTION OF LOUISIANA AND EXPECTED FUTURE TRENDS

A study of the annual fur catch in Louisiana for the 34-year period, 1914-1948, indicates that fur production, though subject to considerable cyclic fluctuations has not, on the whole, decreased, but rather has tended to show a slight increase.

Graph IX illustrates the fluctuations of the total fur production of the State and also the fluctuations of producion of some of the more important species. The most striking fact about the total State fur production is its cyclic nature. Apparently, four cycles have occurred over the 34-year period. Two of these were long, taking 11 years to complete, and two shorter 6-year cycles occurred between the longer ones. During the trough of each short cycle the low point did not go as low as during the longer cycles. It is obvious from a study of the production of the individual species that the cycles of the total production are due entirely to changes in muskrat populations. The muskrat group parallels the total catch closely, while mink and raccoon show a non-cyclic type of variation and a much steadier trend. In fact, except for the low mink years of 1920-21 and the peak raccoon years of 1914-15-16, the trend has been fairly stable and level or slightly increasing. The unusual raccoon production recorded in 1915-16 is probably a result of the great demand for raccoon pelts at that time, rather than a high population. The unusually low mink production of the early 20's coincides with the low for muskrats and is probably a result of generally poor conditions that lowered fur bearer populations. As will be brought out below, it might have been the result of the severe hurricane of 1915.

The cyclic nature of Louisiana's muskrat populations is an interesting and important phenomenon, and, according to O'Neil (1949), attributable to overpopulation and the resulting distruction of all food in the area. O'Neil also points out that peak populations have occurred after some catastrophe such as the severe hurricane of 1915 or the drought of 1924. Presumably such catastrophies kill off most of the rat population and much of the dominant vegetation, i.e., wiregrass (*Spartina patens*). This allows the preferred three-cornered grass (*Scirpus olneyi*) to dominate most of the marsh before muskrat populations are large enough to control its growth or eat the entire supply. Once large areas of marsh become blanketed in three-cornered grass, the rat population increases rapidly until incredible densities are reached and the rats literally eat themselves out of food. The results is a true "eat-out" and a subsequent crash of the population. (See Plate 23.)

This theory as outlined by O'Neil no doubt has considerable merit and may be the sole cause of the cycles. On the other hand, the greater duration of and lower point reached by the long cycles between 1915-24 and 1929-39 indicate that other factors besides an "eat-out" may be in operation. (See Graph IX.) It would seem that if food can be eaten away and returned to normal in the 6-year period of the short cycle, then other factors must aid the "eat-out" in sending the population lower or holding the population low and thereby increasing the time between peaks on the longer cycles. A preliminary study of weather records indicates that extremes of weather may be the additional causative factor as also pointed out by O'Neil, but that the importance of weather and its interrelationship with "eat-outs" are more complex and detailed than he indicated. There has not been time to study this in detail as the pecularity of the cycle was only discovered in analyzing these data. It would seem, however, that the hurricane of 1915, in conjunction with an "eat-out" begun in 1914, drove the rat population so low that, although considerable food may have been restored much earlier, the population did not again reach a peak until 1924. The "eat-out" that occurred in 1924-25 because of overpopulation was accompanied by a drought and, although stories of that period indicate a severe rat mortality, the trapping records fail to show any great loss or even a particularly low period. Apparently, food was restored as weather conditions permitted and the remaining rat population was high enough to produce a peak condition by 1929. If this is indicative, a food shortage caused by an "eat-out" can be restored in 6 years under normal conditions.

In 1929-30, another "eat-out" started, this, as in 1915, was aided in producing the downgrade of the muskrat population by a hurricane in the early thirties. In this case, the rat population was not able to return to a peak until 1939. The "eat-out" and decline of population of 1940 was accompanied only by a mild hurricane and did not go too low to be restored to a peak in 1945-46, forming another short, 6-year cycle. The resulting "eat-out" after the 1945-46 peak, accompanied by a severe hurricane in 1947 and a drought in 1948, has sent the present population to a very low point. If the pattern of the cycle is continued, the forth-coming low should be of some 10 years duration with peak population not being obtained again until 1956-57.

The above discussion is not to be considered more than observations. A detailed study of weather conditions in relation to muskrat population cycles will be carried out as soon as time permits. It would seem that the severity of weather extremes and the time relationship to population peaks and "eat-outs" will prove to be the major controlling factor of the cycle. Apparently drought does not cause as much damage as severe hurricanes which catch the rat population on the downgrade.

MANAGEMENT AND RECOMMENDATIONS

Louisiana's fur crop is an important industry, brings employment and a livelihood to thousands, and is the basic controlling factor in the national fur market. Fortunately, even with only a minimum of management, it has increased. This condition may not continue, however, and studies such as O'Neil's on the muskrat are warranted for the fur industry as a whole and, particularly, for mink. It is also important that as many as possible of the management practices developed by O'Neil be put into effect.

Specific recommendations to aid the fur industry are as follows:

1. Further study should be carried out on the cyclic nature of the muskrat populations.
2. The cause of cycles should be incorporated into management procedures devised by O'Neil (1950).
3. A study of the mink and otter should be made, particularly in relation to the effect of the white ibis and other reported limiting factors.
4. Beaver are more plentiful in the Florida Parishes and should be live-trapped and used to stock other areas.
5. High raccoon populations should be controlled, if possible, since they now have become a nuisance. Probably the best approach to this would be to liberalize night-hunting laws.
6. Some investigations of the nutria's value as a natural weed-control agent in fishing lakes seem warranted.

LITERATURE CITED

Anthony, H. E., 1935. Field book of North American mammals, third edition, G. P. Putnam's Sons, New York.

Arthur, Stanley C., 1931. Fur animals of Louisiana. La. Dept. Conserv. Bull.

Audubon, John J., 1848. Quadrupeds of America. Orig. Pub. Cabildo Museum, New Orleans, Louisiana.

Bailey, A. M. and E. G. Wright, 1931. Birds of Southern Louisiana. The Wilson Bull. V. 43, No. 2, pp. 114-142 and No. 3, 190-219.

Barkalow, Frederick S., Jr., 1948. Lots of factors affect quail covey sizes. Alabama Conservation, Oct. 1948, pp. 6 and 7.

Bateman, Bryant A., 1949. Wildlife—a second crop on forest land managed primarily for timber production. Ph. D. Thesis, University of Michigan Library, pp. 1-141.

Baumgartner, Luther L., 1938. Population studies of the fox squirrel in Ohio. Trans. 3rd North Amer. Wildlife Conf., pp. 685-689.

Baumgartner, F. M., 1944. Bobwhite quail populations on hunted versus protected areas. Jour. Wildlife Mgt., Vol. 8, No. 3, pp. 259-260.

Bellrose, Frank C., Jr., 1944. Duck population and kill. Bull. Ill. Nat. Hist. Survey, Vol. 23, No. 2, pp. 327-372.

Beyer, George E., 1900. The avifauna of Louisiana, with an annotated list of the birds of the State. Proc. La. Soc. of Nat., pp. 75-120.

Beyer, George E., Andrew Allison, and Henry H. Kopman, 1908. List of birds of Louisiana. The Auk, Vol. XXV, No. 2, April 1908, pp. 173-180; No. 4, Oct. 1908, pp. 439-448.

Bick, George H., 1947. The wild turkey in Louisiana. Jour. Wildlife Mgt., Vol. II, No. 2, pp. 126-139.

Brown, Major James, 1948. Migratory waterfowl report 1941-1948. Second Biennial Report, La. Dept. of Wild Life and Fish., 1946-47, p. 151.

Campbell, John S., 1940. Extent of beaver damage to agriculture along the Amite River and its tributaries in St. Helena Parish. Unpublished Agri. Ext. Serv. Report.

DuPrataz, La Page, 1774. The history of Louisiana. (English translation of earlier French volumes.) Pelican Press, Inc., New Orleans, Louisiana.

Ermington, Paul L., and F. N. Hammerstrom, Jr., 1935. Bobwhite winter survival on experimentally shot and unshot areas. Iowa State College Jour. Sci., Vol. 9, pp. 625-639.

French, E. F., 1846. Joutel's historical journal, Historical collection of Louisiana, Part 1, pp. 85-193, Wiley and Putnam, New York.

Frye, O. E., Jr., 1948. Composition and fluctuations of quail populations of Charlotte County, Florida, with particular reference to summer rainfall. (Paper presented at Southeastern Wildlife Conference, Lexington, Ky.) pp. 1-6.

__________1950. (Quail Discussion). Trans. Fifteenth North Am. Wildlife Conf., p. 354.

Goodrum, Phil, 1937. Notes on gray and fox squirrels of eastern Texas. Trans. 2nd. North Am. Wildlife Conf., pp. 499-504.

__________1937. Wise use of forested lands necessary for squirrel conservation in east Texas. Progress Report, Texas Agri. Exp. Sta., No. 459, Aug. 1937, 4 pages.

__________1938. Squirrel management in east Texas. Trans. 3rd North Am. Wildlife Conf., pp. 671-676.

Gowanloch, James N., 1950. White ibis—bird of controversy. La. Conservationist, Jul.-Aug., 1950., p. 13.

Hollis, F. D., 1950. The present status of the wild turkey in Louisiana. La. Dept. of Wild Life and Fisheries pub., 78 pages.

Kopman, Henry H., 1907. Aspects of bird distribution in Louisiana and Mississippi. Auk, Vol. 24, No. 2, pp. 169-181.

__________1921. Wildlife resources of Louisiana, their nature, value, and protection. La. Dept. Cons., Bull. No. 10, 163 pages.

Lauckhart, J. B., 1950. Determining the big game population from the kill. Trans. 15th North Am. Wildlife Conf., 1950. Pub. Wildl. Mgt. Inst., Washington, D. C.

Leopold, Aldo, 1942. Game Management. Charles Scribner's Sons, New York.

Leopold, A. Starker, 1944. The nature of heritable wilderness in turkeys. Condor, Vol. 46, No. 4, pp. 133-197.

Lowery, G. H., 1936. A preliminary report on the distribution of the mammals of Louisiana. Proc. La. Acad. of Sci., Vol. 3, 1936, pp. 11-39.

__________1943. Check-list of the mammals of Louisiana and adjacent waters. Occasional papers of the La. State University Mus. of Zool., No. 13, 1943, pp. 213-257.

__________1955. Louisiana Birds. Louisiana State University Press, pp. i-xxix, 1-556.

Lowery, G. H., and W. B. Davis, 1942. A revision of the fox squirrels of the lower Mississippi Valley and Texas. Occasional papers of the La. State Univ. Mus. of Zool., No. 9, pp. 153-172.

Marsh, A., 1949. Fox and quail studies in west Tennessee. Paper delivered to Southeastern Wildlife Conf., Nags Head, N. C., 13 pages.

McIlhenny, E. A., 1914. The wild turkey and its hunting. Doubleday and Co., pp. 1-245.

Moore, George C., and Allen M. Pearson, 1941. The mourning dove in Alabama. Ala. Dept. Cons. pp. 1-38.

Mosby, Henry S. and Charles O. Handley, 1943. The wild turkey in Virginia. Pub. Div. Fish and Game, Comm. of Game and Inland Fisheries, Richmond, Va.

Newsom, J. D., 1950-51. Unpublished quarterly and annual reports. Pittman-Robertson Project 15-R, La. Dept. of Wild Life and Fisheries Files.

Olson, S. F., 1938. A study in predatory relationship with particular reference to the wolf. Sci. Monthly, Vol. 46, No. 4 ,pp. 323-336.

O'Neil, Ted, 1948. Project 9-D—Coastal Marsh Development. Second Biennial Report, La. Dept. of Wild Life and Fisheries, 1946-47, pp. 166-186.

__________1949. The muskrat in the Louisiana coastal marshes. Pub. Fed. Aid Sec. La. Dept. of Wild Life and Fisheries, 152 pages.

Penn, George H., Jr., and H. Eugene Wallace, 1942. (1) Quail investigations in Louisiana. (2) Inventory of bobwhite in northern Louisiana. Proc. La. Acad. of Sci., Vol. VII, 1943, pp. 43-48.

Perkins, C. J., 1950-51. Unpublished records on quail kill. La. Dept. of Wild Life and Fisheries, Fed. Aid Sec. files.

Phelps, C. F., 1942. Winter losses of the bobwhite. Virginia Wildlife, Vol. 6, No.1, pp. 18-22.

__________1948. Some results of quail restocking experiments in Virginia and neighboring states. Virginia Wildlife, Vol. 9, No. 4.

Redmond, Howard R., 1949. The relation of gray squirrel population to habitat conditions in Stone County, Mississippi. Master's Thesis, La. State Univ. Library, pp. 1-41.

Schultz, C. 1810. Travels on an inland voyage through the States of New York, Pennsylvania, Virginia, Kentucky, and Tennessee, II, pp. 182-184. (As quoted by Wright, A. H., 1915. Early records of the wild turkey. Auk, Vol. 32, No. 2, pp. 213-215.)

Stoddard, H. L., and C. O. Handley, 1931. The food and feeding habits of bobwhites. Chap. VI, pp. 113-166. (From Stoddard, H. L., 1936—The Bobwhite Quail, Charles Scribner's Sons, New York.)

Thigpen, Thomas Doyle, 1950. A study of beaver in Louisiana. Master's Thesis, La. State Univ. Library, pp. 1-170.

Thompson, St. Clair, 1949. An analysis of a sample quail harvest in Mississippi. Paper delivered at Southeastern Wildlife Conf., Nags Head, N. C., pp. 1-5.

Wheeler, Robert J., 1948. The wild turkey in Alabama. Pub. Ala. Dept. Conserv., Pittman-Robertson Projects, pp. 1-92.

Yancey, Richard K., 1950-51. Quarterly and annual reports. La. Fed. Aid Proj. 17-R, La. Dept. of Wild Life and Fisheries (Unpublished).

Young, Stanley P., and Edward A. Goldman, 1944. The wolves of North America. Am. Wildlife Inst., Washington, D. C.

GENERAL REFERENCES

Brown, Clair A., 1945. Louisiana trees and shrubs. La. Forestry Comm. Bull. No. 1, pp. 1-262.

Cruikshank, James W., 1939. Forest resources of Southwest Louisiana. Forest Survey Release, No. 43, Apr. 1939. Sou. Forestry Exp. Sta., New Orleans, La., pp. 1-38.

Eldredge, I. F., 1938. Forest resources of Northwest Louisiana. Forest Survey Release No. 31, Mar. 1938. Sou. Forestry Exp. Sta., New Orleans, La., pp. 1-21.

Faulks, E. B., 1938. Forest resources in the longleaf pine region of Mississippi and East Louisiana. Forest Survey Release, No. 39, Nov. 1938, Sou. Forestry Exp. Sta., New Orleans, La., pp. 1-34.

Leopold, Aldo, 1942. Game management. Charles Scribner's Sons, New York, pp. 1-481.

McAtee, W. L., 1943. Some local plant names—VIII. Torreya, Vol. 42, pp. 153-168.

__________1939. Wildfowl food plants. College Press, Inc., Ames, Ia., pp. 1-127.

Robinson, B. L., and M. L. Fernald, 1908. Gray's Manual of Botony, 7th ed. (revised). American Book Co., New York, pp. 1-903.

Small, John K., 1933. Manual of the Southeastern Flora. The Sci. Press Printing Co., Lancaster, Pa., pp. 1-1554.

Stoddard, Hebert L., 1936. The bobwhite quail. Charles Scribner's Sons, New York, pp. 1-545.

Trippensee, Ruben E., 1948. Wildlife Management. (First edition) McGraw-Hill Book Co., Inc., New York, pp. 1-449.

Winters, R. K., 1939. Forestry resources of the south Louisiana delta Forest Survey Release No. 42, Mar. 1939, Sou Forestry Exp. Sta., New Orleans, La., pp. 1-20.

Winters, R. K.; Putnam, J. A.; and I. F. Eldredge; 1938. Forest resources of the North Louisiana delta. U. S. Dept. Agri. Miscel. pub. No. 309, Washington, D. C., Aug. 1938, pp. 1-49.

Winters, R. K.; Ward, G. B.; and I. F. Eldredge, 1943. Louisiana Forest resources and industries. U. S. Dept. Agri. Miscel. pub. No. 519, Washington, D. C., Aug. 1943, pp. 1-44.

Van Dersal, William R., 1938. Native woody plants of the United States. U. S. Govt. Printing Office, Supt. Documents, pp. 1-322.

__________1920-1945. U. S. Census of Agriculture for Louisiana. Dept. of Commerce. U. S. Govt. Printing Office, Supt. of Documents, 6 publications.

__________1947. Forest resources of Louisiana. 2nd ed. pub. by Louisiana Forestry Comm., pp. 1-86.

__________1894. Louisiana, its products, soil, and climate. Pub. by Bureau of Immigration. Baton Rouge, La. (Out of print). Available La. State Univ. Library, pp. 1-180.

__________1944-1949. Biennial Reports of the Louisiana Dept. of Wild Life and Fisheries, Nos. 1, 2, and 3. Pub. by Dept of Wild Life and Fisheries, New Orleans, Louisiana.

__________1913-1942. Biennial and other reports of the Louisiana Dept. of Conservation. (Out of print). Available La. State Univ. Library.

__________1900-1950. Louisiana crop reports. Louisiana Dept. of Agri. publications. (Many out of print). Available Louisiana Room, Louisiana State Univ. Library.

__________1944. The distribution of the flora and fauna of Louisiana in relation to its geology and physiography. A symposium by Holland, W. C.; Penfound, Wm. T.; Brown, Clair A.; Viosca, Percy, Jr.; and George H. Lowery. Proc. Louisiana Acad. of Sci., V. 8, pp. 11-73.

_________The Climate of Louisiana; yearbook of agriculture. 1941, pp. 893-903.

1848-B, 9-59

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